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haec dissertatio, ea conditione, ut, simulac typis fuerit excusa, numerus exemplorum lege praescriptus collegio tradatur ad libros explorandos constituto.

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*Dr. **Samson**,*
ord. med. h. t. Decanus.

№ 91.
(L. S.)

MANIBUS PATRIS

SACRUM.

Si forte mihi contigerit, ut investigationibus, quae subsequuntur, ad obscuram labyrinthi auris partem melius cognoscendam aliquid contulerim, hoc maxime ad praeceptorem summe venerandum professorem Dr. *Bidder*, qui me observationum microscopicarum instituendarum rationem atque viam docuit, acceptum refero; cujus rei viro doctissimo toto animo debitas gratias persolvo.

Neque non libenti animo hanc occasionem arripio, ceteris quoque hujus universitatis professoribus, praeceptoribus honoratissimis, quorum sub auspiciis artis medicae studia colere mihi licuit, gratias quam maximas agendi.

Praefatio.

Quum in disquisitionibus, quas in medium prolaturus sum, ipse expertus sim, quam optabile sit, si quis ad rem aliquam pertractandam accedat, eas methodos, quibus alii jam scrutatores usi sunt, cognitas esse, ne videlicet eosdem errores committat, quos evitare illi demum in pervestigationum decursu sensim ac paullatim didicerant, utque ab ipso initio, animo ad difficultates, quae objiciantur, converso, eas quam brevissima via superare liceat, equidem aptissimum esse existimo, antequam ad tractandam rem propositam transeam, tum modum ac rationem, qua, me judice, cochlea facillime ex osse petroso sejungi queat, tum chemicam agendi rationem exponi, qua contingat, res microscopicas certius perspicere. — Uti hoc loco, item postea, quum cochleam totam cum ejus pariete externo parare a fine commentationi meae proposito alienum sit, tantummodo de interioribus cochleae partibus disseram.

Investigationes meas in vitulo, in fele, in cane, in equo factitavi. Qua in re, cranio directione verticali in sutura sagittali ope serrae dissecto, quum ita duo dimidia lateralia divisissem, cerebro amoto, lateralia cranii ossa, forcipibus, eorum crassitudini respondentibus, abrumpebam, ut ad os petrosum elaborandum plus spatii liberi suppeteret. Quod dum fit, dura mater, hic illic ossi adhaerens, solvitur indeque facile a tota cranii superficie interna distrahi potest, quo facto, pars petrosa ossis temporum, quae tum peculiari colore tum duritie a vicinis cranii ossibus magnopere discrepat, in conspectum venit.

Ad cochleae cavum aperiendum parvis forcipibus, quae ad similitudinem forcipum unguibus desecandis usitatarum in apicem exibant, utebar. Quibus forcipibus facile quodvis quantumlibet ossis frustum abrumpere licet. Ceterum, utrum os petrosum, quo utare, ab animali adulto, an ab animali tenerae aetatis petitum sit, multum interest. Etenim in casu posteriore massa ossea lamellam tenuem mollemque constituit, quae, ut internae cochleae partes denudentur, quam cautissime ope forcipis auferenda est. E contrario in casu priore, quum os petrosum jam admodum consolidatum sit, aptum non est, massam osseam fragilem duramque parvis frustulis solvendo, paullatim progredi, quoniam sic periculum est, ne laminam spiralem laedas, quum lamellam obtegentem, si quidem jam omnino attenuata est, ad postremum in attollendi conatu forcipe facillime perfores. Contra ea, si, canali Fallopiae aperto, pariterque inde a meatu auditorio interno ad posteriorem ossis petrosi marginem canali formato, hac directione os audacter forcipe dirumpere conatus eris, ossis petrosi apex ita resolvitur, ut, cavo cochleae patefacto, modiolus cum lamina spirali ex tertia, quin etiam ex dimidia ambitus sui parte nudatus atque integer adspectui pateat. Deinde facillimum est, prout libitum fuerit, etiam reliquam tegumenti partem abrumpere, testamque cochleae veluti a nucleo detrahere.

Si id agitur, ut laminae spiralis laesio quam certissime evitetur, id quod in finem disquisitioni propositum plurimi refert, maxime in rem est, os petrosum ab ossibus circumjectis disparari, indeque a cavo tympani, primo interstitium inter fenestram rotundam fenestramque ovalem interpositum abrumpendo, cavum cochleae aperiri. Ceterum, dummodo aliquam adeptus fueris exercitationem, etiam ratione priore finem certe adsequeris, in qua quidem ineunda id praebetur commodi, quod eam breviore temporis spatio exsequi licet.

Semper lamina spiralis membranacea in triente eo, qui externo cochleae parieti adjacet, dirumpitur, ideoque per majus latitudinis spatium cum lamina spirali ossea in connexu manet, quem non sublatum esse, in nervorum decursu perquirendo omnino necessarium est.

Mihi, quum investigationum in cochlea instituendarum initium facerem, conditio illa, quam *Corti* in commentatione

sua satis nota ad successum disquisitionum prosperum omnino necessariam esse judicavit, res ut multo difficilior videretur, quam re vera est, causam attulit. Etenim hic scrutator clarissimus talibus verbis utitur[1]) „La difficulté que présente l'étude des parties molles de l'organe de l'ouïe, et des organes des sens en général est assez évidente, si l'on considère le peu de résultats qu'ont eu les anatomistes qui s'en sont occupés jusqu'à présent. Certainement quant au limaçon, en employant même les méthodes de préparation les plus favorables pour chaque tissu, il sera toujours nécéssaire de faire un nombre considérable de préparations afin de voir tous les détails histologiques. La cause en est surtout en ce qu'une grande partie des éléments histologiques de l'organe de l'ouïe ainsi que de l'organe de la vue ne peuvent être observés que dans des préparations tout-à-fait fraiches et presque toutes chaudes." Cui opinioni non solum loco allato, sed etiam in commentationis illius decursu saepius prolatae equidem nullo modo assentiri possum, qua de re in considerandis singulis telis, ad quas observandas *Corti* cochleas nisi recentes adhiberi non posse affirmat, infra mentionem injiciam. Neque magis equidem, quamquam commutationes histologicas cum diligentia curaque sane admirabili expositas esse confitear, commodum illud, quod vir doctus in singulis telis contemplandis chemica agendi ratione sibi praebitum esse testatur, usu cognoscere potui.

Sententiae Cortianae, supra allatae, ***Koelliker***[2]) quoque adstipulatur, quippe qui haec dicat: „Zur Untersuchung des Gehörorgans, welche nur beim Labyrinthe, hier jedoch sehr bedeutende Schwierigkeiten darbietet, sind unumgänglich vollkommen frische Objecte, am besten eben getödteter Thiere nöthig und ist bei derselben zur Befeuchtung nur Serum oder Zuckerlösung zu verwenden, wenn man die Theile ganz normal sehen will." Verumtamen telae, de quibus agitur, quantum mea fert opinio, neque tam facile destruuntur, ut

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1) *A. Corti:* Recherches sur l'organe de l'ouïe des mammifères. Première partie. Limaçon. pag. 35. in: *Siebold* und *Kölliker* Zeitschrift für wissenschaftliche Zoologie. Bd. III. Heft I. 1851.

2) *Kölliker,* Handbuch der Gewebelehre des Menschen. 2. Aufl. Leipzig 1855. pag. 670.

eas tantummodo in praeparatis omnino recentibus ac paene etiamnum calentibus observare contingat, neque ratio, quam, substantiis reagentibus chemicis in usum vocatis, ostendunt, alia est, atque quae in cognatis ceterarum corporis partium telis observatur. Causa potius, qua fiat, ut, quamvis magnam praeparatorum copiam habeas, tamen saepius non contingat, ut partes, in quas inquirere velis, intueri liceat, longe alia est, qua quidem de re, quum ista causa in partibus aliis alia sit, infra in singularum partium contemplatione fusius disseram. Si vero, uti *Corti* existimat, difficultas inde tantum penderet, quod telae tam facile destruantur, illa quidem in omnibus partibus una eademque esset necesse foret. Equidem in disquisitionibus meis instituendis cochleas, quae longius per tempus in acido muriatico diluto, cui singulae partes ClH, denae HO inessent, asservatae fuissent, omnibus postulatis quam maxime satisfacere observavi. Illa enim tractandi ratio haec commoda praebet.

1) Lamellae osseae tali modo emolliuntur, quae quidem non modo eo, quod situ naturali magnam nervorum cochleae partem includunt, sed etiam eo, quod in praeparato discerpendo partibus maximi momenti saepe incumbunt, observatori multum obsunt. Illa methodo vero totum praeparatum pellucidius exsistit.

2) Sola hac ratione, nisi forte cochleas, ab animalibus tenerrimae aetatis petitas, in quibus ossificatio nondum ita progressa est, in promptu habueris, segmenta transversa per totam laminam spiralem extensa parari possunt. Quin etiam cochleis etiamnum cartilagineis, ab animalibus tenerae aetatis desumtis, cochleae animalium magis evolutorum, acido muriatico tractatae, praestant. Etenim in illis lamina spiralis membranacea, indolem quasi gelatinosam offerens, minoris est soliditatis, quam quae segmenta transversa ope cultri vel forficis efficiendi potestatem faciat. Quo in casu nunquam obtingit, ut segmenta illa tam tenuia pares, quam quae acido muriatico usus accipias. Ad elementorum histologicorum evolutionem quod attinet, qualis in animalibus illis tenerae aetatis appareat, partes istae jam omnes perfecte evolutae cernuntur. Talium animalium cochlea, si laminae spiralis partes, de quibus quaeritur, statu recenti atque inde a superficie perquirendae sunt, aptissimam sese exhibet; sin

autem eam adhibere volueris segmentis transversis parandis, prius illam acido chromico indurari suaserim.

Si segmenta transversa tenuia per totum modiolum extensa, quae directione verticali ejus axem feriant, parare volueris, ut videlicet tum fasciculorum nervorum in modiolo dispositio, tum eorum in laminam spiralem osseam transitus in conspectum detur, et cochleae nondum ossificatae et cochleae tales, ex quibus calcariae sales ope acidi muriatici extracti sint, non minus commendandae videntur. Hac in re tamen id incommodi offertur, quod cochlea sola per se et minor est, quam quae in secando satis immota teneri queat, et mollior, quam quae cultri aciei satis reniti valeat. Saltem hoc in casu segmenta modioli effici non possunt, nisi cum cochlearum complurium jactura, quoniam magnae earum partes quae satis commode ad alias scrutationes adhiberi possent, sic perduntur. Cui incommodo aliquo modo occurrendum est, quo modiolus cum lamina spirali massa quam celerrime indurescente, quae statu indurato secari possit, circumdetur. Similem in finem, fuerunt antea, qui cera, qui gutta percha in chloroformylo soluta etc. uterentur; attamen materiae illae fini proposito neutiquam satisfaciunt. Namque in universum massae hucusque in usum vocatae demum aliquot diebus circumactis indurescunt, neque superficiem secando factam satis laevem praebent, quo adde, quod nonnunquam aut viscidae manent, aut saltem, si manibus tetigeris, calore tenaces ac glutinosae evadunt.

Alia solutionis ichthyocollae ratio est, quam ut adhiberem, professor Dr. *Schmidt*, vir doctissimus, mihi auctor exstitit. Ichthyocolla et facile in aqua bulliente solvitur et refrigerata paucis sexagesimis talis exsistit, ut in fila extrahi possit et nonnullarum horarum spatio tantopere indurescit, ut vel tenuissima segmenta transversa cultro efficere queas. Quo accedit, quod haec solutio id commodi suppeditat, ut, quum refrigerata satis pellucida maneat, directio, quae in secando sequenda sit, certo definiri possit. Quae massa optime tum, quum primum talis exstitit, ut in fila extrahi queat, modiolo imponitur.

Ut segmenta, quocunque ea confeceram modo, pellucidiora et ad disquisitionem microscopicam aptiora redderem, ea vel acidis acetico et sulphurico dilutis vel solutione

natri caustici, vel etiam glycerino tractavi, quarum substantiarum utra ad finem propositum alteri praestet, aegre dijudicem, quum omnibus laus summa tribuenda sit. Praeterea vero et praeparata ex animalibus modo necatis desumta et segmenta memorata non adhibitis reagentibus illis disquisivi, ut comparandi occasio praeberetur.

Hae sunt methodi, a me in usum conversae, ut cochleae partes, in quas inquirendum erat, observationibus ope microscopii suscipiendis idoneae redderentur.

Caput I.

De partibus cochleam efformantibus in genere.

Quum anatomicas cochleae rationes omnes exponere non sit hujus commentationis, ea tantum repetere liceat, quae necessario nexu cum cochleae nervis eorumque decursu peripherico continentur.

Cochlea Fallopiae s. cavitas cochleata s. antrum buccinosum Vesalii s. concha auris, quum summam formae helicis similitudinem referat, jam saepe cum hac comparata est. Ejus testa spatium excavatum, quod nomine ductuum spiralium seu gyrorum dicitur, continet, in cujus parte media nucleus forma pyramidali instructus inest, qui modiolus Valsalvae s. axis s. nucleus cl. du Verney s. conus s. pyramis appellatur. Circa hunc nucleum, a basi cochleae usque ad ejus cupulam porrectum, canalis spiralis cochleae gyris ferme duobus cum dimidio circumvolvitur, qua in re septo quodam in interiore parte per totam longitudinem decurrente, quod laminae spiralis nomine designatur, in duas portiones dirimitur, quarum inferior*) foramine rotundo cum cavo tympani, superior cum

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*) Hac in denominatione rei contemplationem vulgo usitatam sequor, secundum quam cochleae apex pro ejus parte superiore, basis pro inferiore habetur.

recessu hemisphaerico vestibuli conjuncta est. Quam ob causam illa pars scala tympani, haec scala vestibuli dicitur. Foramen rotundum satis constat membrana tympani secundaria occlusum esse, dum scala vestibuli, uti usque ad hunc diem vulgo credebatur, liberum in vestibulum transitum habet. Attamen haec rei ratio tempore recentissimo a ***Reissner*** [3]) prorsus negata fuit, quo testante, duae cavitates illae pariter inter se disparatae sunt, atque scala tympani a cavo tympani. Scala tympani initio amplior est, quam scala vestibuli, excepto fortasse primo initio pone fenestram rotundam posito, postea vero, quo propius ad cupulam accedit, eo angustior arctiorque, quam illa, apparet, lamina spirali hac in parte magis magisque ad scalae tympani fundum descendente.

In modiolo, si a regione inferiore ad superiorem adscendas, tres discernendae sunt partes, nempe primum basis modioli, circa quam gyrus primus, isque longissimus, decurrit, tum columella, cui cum gyro secundo eadem intercedit ratio, denique lamina modioli, quae ad testam versus in cochleae apice porrecta cum illa coalescit atque margine acuto libero, lunae dimidiatae simili paullulumque incurvato, finitur. Lamina modioli gyro semitertio cincta est.

Modioli basis lata atque conica est, et, in facie sua inferiore dilatata, foveam latam efformat, in qua linea spiralis, e foraminibus consistens (tractus spiralis foraminulentus) fere duobus gyris porrigitur. Quae foramina parvula eo propius alterum alteri posita sunt, eoque minora cernuntur, quo propius ad centrum baseos accedunt, excepto tamen foramine medio, quod cetera magnitudine superat.

Haec foramina omnia ad canaliculorum tenuissimorum systema in interiore modioli parte situm ducunt, qui canaliculi, dum ipso initio eandem, quam paries externus, directionem sequuntur, postea omnes deinceps, angulo paene recto, ad exteriora convertuntur. Hac in re primum canaliculi extremi, qui foraminibus, in tractus spiralis forami-

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3) *E. Reissner*, Zur Kenntniss der Schnecke im Gehörorgan der Säugethiere und des Menschen in *J. Müller's* Archiv für Anat. etc. Jahrgang 1854. fasc. 5. pag. 424.

mulenti initio positis, respondent, deinde canaliculi, qui magis in interiore modioli parte decurrunt, denique canalis in axe positus, cui idcirco canali centrali modioli nomen est, quique a foramine maximo, de quo modo mentionem intulimus, exit, ad partem exteriorem vertuntur. Quem canalium e modiolo egressum per se intelligitur non in una eademque planitie fieri posse, sed potius canales isti, quanto profundius in interiore modioli parte inclusi sunt, tanto longiores exsistant tantoque propius cochleae apicem e modiolo excedant necesse est. Quo fit, ut canalis modioli centralis demum ad laminam spiralem in conspectum veniat. Hac dispositione regulari efficitur, ut, canaliculis ad partem exteriorem sese convertentibus, linea spiralis circa modiolum extensa conformetur. In hac linea spirali canaliculi, qui et a parte superiore et ab inferiore lamella quadam ossea, e modioli parietibus prodeunte, includuntur, ad peripheriam versus porriguntur. Sic septi duas scalas inter se dirimentis, supra jam commemorati, pars interior, quae lamina spiralis ossea nominatur, exsistit, quae lamina margine libero in cochleae canalem spiralem prominet. Canales inter duas laminas inclusi hac forma non, uti *Scarpa*[4]) contendit, ramulos emittentes usque ad marginem liberum decurrunt, sed in primo laminae spiralis osseae triente amplificati cavum pro rata parte magnum efformant, quod specie ductus spiralis praeditum inter lamellas inde a cochleae basi ad apicem usque extenditur. Ad cochleae peripheriam versus rursus substantia ossea inter laminas interjecta invenitur, qua rete tenuissimis maculis instructum conformatur.

Lamina spiralis ossea, teste *Corti*[5]), in cochleae basi 0,7‴—0,8‴ latitudine aequat, ad cupulam versus autem angustior angustiorque evadit. Pariter ejus crassitudo eadem directione minuitur. Longitudo illius secundum mensiones ab eodem auctore institutas 9,5‴—10,5‴, crassities in gyri primi initio proxime modiolum 0,2‴, in margine libero 0,006‴—0,007‴ aequat. Contra laminam spiralem osseam in interiore parietis cochleae superficie lamina similis, at ea tamen

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4) *A. Scarpa*, Anatomische Untersuchungen des Gehörs und Geruchs. Aus dem Lateinischen. Nürnberg 1800. pag. 75.

5) l. c. pag. 8.

minus distincta atque evoluta, conspicitur, quae, lamina spiralis accessoria ab *Huschke* dicta, pariter ad apicem versus magis magisque deminuta, ad postremum in gyro semitertio omnino evanescit. Inter duas has lamellas membrana, quae lamina spiralis membranacea appellatur, extensa est, qua ita canalis spiralis cochleae in duas partes disparatio plene perficitur. Verumtamen hae duae partes non omnino altera ab altera disjunctae sunt, sed inde ab extremo laminae spiralis osseae apice lamina spiralis membranacea, margine libero cuculli ad instar circumvoluto, usque ad cupulam adscendit, ita ut scyphulus membranaceus efformetur, in quo duae scalae, nusquam praeterea inter se communicantes, conjunguntur.

Omnes parietes ossei, uti in aliis partibus, item in cochlea periosteo obducti sunt.

Vasa, quae cochleae insunt, ex arteria auditoria interna, quae in meatus auditorii interni fundo in arteriam vestibuli et arteriam cochleae dividitur, originem ducunt. Arteria cochleae circiter quattuordecim [6]) ramulis per aperturas tractus spiralis foraminulenti in modiolum sese confert, qui ramuli hinc laminam spiralem perforant atque in scalis, praesertim in scala vestibuli, extenduntur.

Cochleae venae decursum arteriae cochleae sequentes denique in venam auditoriam internam, quae ad sinum petrosum superiorem tendit, transeunt.

Nervus cochleae s. ramus anterior nervi acustici, ex trunco nervi auditorii in foveam ad cochleae basim positam porrectus, hoc loco in magnam filorum tenerrimorum tenuiumque multitudinem dividitur, quae fila, per tractus spiralis foraminulenti aperturas in modioli canaliculos transgressa indeque angulis rectis reflexa, inter laminae spiralis osseae lamellas intrant.

Quae rationes anatomicae, si calcariam in cochlea obviam ope acidi muriatici amoveris, quam optime adspectui patent. Tum enim unumquemque fasciculorum, quibus nervus consistit, oculo inermi discernere atque per decursum suum persequi licet.

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6) *Huschke*, Lehre von den Eingeweiden und Sinnesorganen des menschlichen Körpers. Leipzig 1844. pag. 891.

Caput II.

De lamina spirali membranacea in specie.

Antequam ad contemplandum cochleae nervum ipsum ejusque decursum periphericum ac finem transeam, necessarium esse judico, accuratam rationum microscopicarum laminae spiralis membranaceae descriptionem praemitti, quoniam ex omni inde tempore omnes auctores hanc laminam pro ea habuerunt parte, in qua fibrae nerveae finirentur, quamvis ne ad hunc quidem diem inter omnes satis conveniat, quonam ejus loco et quanam forma id eveniat. Etenim, sive ultimi nervi cochleae fines, uti infra explanabitur, in scala tympani, sive in scala vestibuli positi esse creduntur, ac sive ille nervus penicilli, sive laquei forma terminari putatur, sive denique, id quod nuperrime affirmatum est, in spatium vacuum cum cellulis terminalibus aut sine his excurrit; certe in eo omnes observatores consentiunt, hos fines in lamina spirali membranacea quaerendos esse. Attamen ex hac ipsa virorum doctorum dissensione facile concludi potest, elementa nervea, quae his in partibus adsint, plerisque in casibus aut omnino non reperta, aut, si quando reperta essent, non recte cognita, aut alia elementa a nervis omnino differentia a scrutatoribus pro nervis habita esse.

Itaque, si id agitur, ut controversia de nervi cochleae terminatione transigatur, omnium primum partes laminam spiralem membranaceam constituentes quam diligentissime describantur oportet, quo facto demum quaestio moveri potest, num harum partium una vel altera omnibus satisfaciat postulatis, ut secundum ea, quae hucusque de nervorum finibus comperta habentur, pro tali fine putari possit.

Haec postulata autem talia sunt.

1. Directus connexus cum fibris nerveis haud dubiis, ex modiolo proficiscentibus, adsit necesse est. Ejus modi continuitatem enim ad hanc quaestionem decernendam omnino necessariam esse, satis constat. Itaque elemento alicui morphologico, de quo ambigitur, tum demum natura nervea

adscribi potest, quum directa ejus conjunctio cum fibris nerveis ex centro oriundis jam certo demonstrata est. Quodsi contigerit, ut caligo, qua ratio extremis, quae vocantur, fibris nerveis cum singulis laminae spiralis membranaceae partibus intercedens hucusque involuta fuit, discutiatur atque dispellatur, jam luculenter apparebit, quam falsae atque inanes nonnullae sententiarum, de quibus mentionem intulimus, fuerint. Ex altera parte vero praepropere agit omniaque, quae ad hoc tempus pro ratis habebantur, placita negligit atque obterit, si quis, sola hac continuitate innixus, elementum aliquod pro nerveo duxerit, quamvis cetera nervorum signa deficiant. Est potius, si de natura alicujus elementi quaeritur,

2. hoc secundum illas regulas dijudicandum, quas nobis anatomia microscopica suppeditat. Quae regulae observationibus atque experientia nituntur, quae, his duobus decenniis diligentissime collectae, quamvis certe nonnullis in rebus adhuc locupletentur atque etiam emendentur oporteat, tamen, si, nulla opinione praejudicata ductus, eis uti volueris, quaestionis ad liquidum explorandae potestatem faciunt.

3. Denique rerum ratione chemica agentium ad partes eas, quarum naturam cognoscere velis, vim atque effectum considerari oportet, ut hinc quoque ad sententiam ferendam aliquid adminiculi repetatur.

In his tribus gravissimi momenti rebus, si congruentiam cum iis, quae experientia et observationes hucusque docuerunt, animadvertimus, sane dijudicatio difficilis aut anceps esse nequit, dum ex altera parte, si his postulatis non satisfactum esse intelligimus, nobis nullo modo jus suppetit, elemento alicui morphologico naturam nerveam attribuendi, atque, ut novi aliquid statuamus, ea, quae ad hunc diem rata habebantur, pro falsis putandi.

Ex omni tempore in lamina spirali membranacea complures partes distingui solebant. Qua de re, quae a summae auctoritatis scrutatoribus prolata sunt, exponere liceat, ut in descriptione infra proponenda equidem singulas partes jam memoratas simpliciter respicere possim, lector vero benevo-

lus facilius intelligere queat, qua de parte verba fiant. Auctor, qui primus laminam spiralem membranaceam accuratius descripsit, *Scarpa* [7]) est. Hic eam in portionem cum libero margine laminae spiralis osseae intime concretam, quae, inter cartilaginem et membranam intermedia, indolem coriaceam praebeat, et portionem penitus membranaceam ac paene mucosam dividit, quae posterior septum inter duas scalas plene perficiat. In quarum portionum priore fluidum quoddam aquosum inesse contendit, praesertimque illius marginem externum cum tubulo, fluido isto impleto, comparat.

Divisionom hanc, quam primus *Scarpa* protulit, etiam *Weber* [8]) et *Huschke* [9]) acceperunt. Quorum uterque, texturae ratione babita, portionem cartilagineam et portionem membranosam discernit. *Huschke* hac de re talia ait: „Die knorplige Zone (zona cartilaginea) schliesst sich unmittelbar an den freien Rand des knöchernen Spiralblatts an, wie die häutige an die knorplige und den äussern Umfang der Schneckenwindung. Sie ist $\frac{1}{6}'''$—$\frac{1}{7}'''$ breit und $\frac{1}{12}'''$—$\frac{1}{13}'''$ dick, biegsam aber ziemlich fest, kehrt wie das knöcherne Spiralblatt die eine untere Fläche der Paukentreppe, die andere obere der Vorhofstreppe zu, und heftet sich mit ihrem innern hohlen Rande an den gewölbten Rand der knöchernen Zone, mit dem äussern gewölbten an die häutige Zone. Ihre untere Fläche ist eben, die obere dagegen erhebt sich in der Nähe des äussern Randes zu einer hakenartig nach aussen gekrümmten Spiralleiste (crista spiralis acustica). Betrachtet man daher einen feinen Durchschnitt des knorpligen Spiralblattes von der Schnittfläche, so erscheint sein äusserer Rand als eine tiefe, mit zwei Lippen versehene, $\frac{1}{30}'''$ hohe und $\frac{1}{20}'''$ tiefe Furche (sulcus s. semicanalis spiralis), welche in der Vorhofstreppe herabläuft. Von der einen Lippe, die man Paukenlippe (labium tympanicum) nennen könnte, geht die häutige Zone ab. Sie ist der eigentliche äussere Rand der knorpligen Zone. Die andere Lippe hingegen, die man auch wegen ihrer Lage auf der Vorhofsfläche die Vor-

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7) l. c. pag. 87 et 88.

8) *E. H. Weber*, Handbuch der Anatomie des Menschen. Braunschweig 1832. Vol. IV. pag. 28.

9) l. c. pag. 883—885.

hofslippe (labium vestibulare) nennen könnte, springt nicht so weit vor als die Paukenlippe, endet aber als ein freier Haken in der Vorhofstreppe und ist eben obige Gehörleiste selbst, welche schraubenförmig mit der Spiralfurche durch die verschiedenen Windungen herabläuft." Porro *Huschke* sic pergit [10]) „Die häutige Zone (zona membranacea) ist ein sehr zartes Häutchen, nur von $\frac{1}{600}'''$—$\frac{1}{640}'''$ Dicke und von einer Breite von $\frac{1}{14}'''$—$\frac{1}{16}'''$. Es fängt mit seinem hohlen Rande am gewölbten Rande der Paukenlippe des knorpligen Spiralblattes an und schliesst sich, allmählich dicker werdend, an die Bekleidung der beiden Treppen mit seinem gewölbten äussern Rande an."

Todd et ***Bowmann*** [11]) et ipsi duas laminae spiralis membranaceae portiones statuunt, quarum priorem tamen ob processus quosdam peculiares dentibus incisivis consimiles, qui in illa reperiuntur, „denticulate lamina", alteram „inner clear belt of the membranous zone" appellant. Eandem divisionem etiam ***Breschet*** [12]) et *Hannover* [13]) sequuntur, id modo a prioribus discrepantes, quod, totam laminam spiralem contemplantes, tres ejus zonas distinguunt. Prior enim zonam osseam, zonam medianam et zonam membranaceam, posterior portionem osseam, portionem semipellucidam et portionem membranaceam statuit.

Pariter ***Bendz*** [14]) tres laminae spiralis membranaceae partes discernit, nempe laminam spiralem osseam internam (indre Blad), in margine externo stria cartilaginea instructam, zonam membranaceam (hindeatige Zone), laminamque spiralem osseam externam (ydre Blad). Quae ultima eadem est, quam ***Huschke*** laminam spiralem accessoriam nuncupat.

10) l. c. pag. 887.

11) *Corti,* Recherches sur l'organe de l'ouïe etc. pag. 41. Commentationem ipsam adire non licuit.

12) *Todd,* Cyclopaedia of anatomy and physiology. Part. II. Organ of Hearing. pag. 534. Commentationem ipsam *Brescheti* adire non licuit.

13) *Hannover,* Recherches microscopiques sur le système nerveux. Copenhague 1844. pag. 506.

14) *Bendz,* Haandbog i den almindelige Anatomie. Kjöbenhavn 1846—47. pag. 506.

Krause[15]) qua causa adductus fuerit, ut a laminae spiralis zonula membranacea, quam vocat, zonulam nerveam distinguat, infra, quo loco de nervo cochleae tractabimus, explanabitur, ubi quidem facile apparebit, quamnam laminae spiralis membranaceae partem vir doctus hoc nomine dixerit.

Corti[16]) denique, disquisitionibus suis praeclarissimis nixus, omnibus, quae antea propositae erant, divisionibus rejectis, secundum apparatum quendam singularem, quem ipse primus in lamina spirali membranacea invenerat, quique, a *Koelliker*[17]) nomine organi Cortiani dictus, laminam illam fere usque ad trientis extremi initium obtinet, suam ipsius divisionem instituit. Hoc auctore igitur lamina spiralis membranacea in duas portiones primarias divisa est, quarum interiorem duas latitudinis laminae partes tertias tenere dicit nomineque zonae denticulatae (zone dentelée) appellat. Trientem externum vero *Corti* zonam pectinatam (zone pectinée) nominat. Zonam denticulatam, a parte interiore ad externam progrediens, in habenulam sulcatam (bandelette sillonée) et habenulam denticulatam (bandelette dentelée) dividit. Quarum prior zonae coriaceae, quam ***Scarpa*** statuit, zonae cartilagineae a ***Weber*** et ***Huschke*** sic dictae, zonae medianae, quam ***Breschet*** appellat, zonae semipellucidae ab ***Hannover*** dictae, margini cartilagineo laminae spiralis osseae internae, uti ***Bendz*** nominat, et laminae denticulatae a ***Todd*** et ***Bowmann*** nuncupatae respondet.

Allatis sic paucis ac breviter laminae spiralis membranaceae divisionibus, quae a diversis auctoribus propositae sunt, ad describendas singulas ejus partes, quales in disquisitione mihi apparuerint, transire liceat. In his, quae nunc exponam, nominibus ab ***Huschke*** et ***Corti*** adhibitis utar. Num vero aliqua earum, quas attuli, divisionum in rationibus anatomicis innitatur, atque num una earum ceteris anteponenda sit, in commentationis decursu elucebit.

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15) *Krause,* Handbuch der menschlichen Anatomie. Bd. I. Th. 2. Hannover 1841. pag. 506.

16) l. c. pag. 10.

17) *Kölliker,* Microsc. Anatomie. Bd. II. 1854. pag. 752.

Lamina spiralis membranacea speciem praebet taeniolae ad lineae spiralis similitudinem incurvatae, cujus longitudo in diversis animalibus pro cochleae magnitudine diversa atque prout cochlea magis minusve curvatur variat. — Haec taeniola, uti jam commemoravimus, inter convexum laminae spiralis osseae marginem atque interiorem testae cochleae superficiem extenditur. Margines laterales firmiter destinati sunt, i. e. eorum tela directo in partium vicinarum telam transit. Qua de causa lamina spiralis membranacea ita credi potuerit exorta esse, ut utriusque lateris periosteum directe in eam continuetur.

Quae res in interno margine ad laminam spiralem osseam converso tali modo evenit. Quum periosteum, vestibularem laminae spiralis osseae superficiem obducens (Fig. I, II et III. A—B), tum periosteum, quo superficies ejusdem tympanalis vestita est (Fig. II et III, A′—B′), ad peripheriam versus ad formandam laminam spiralem membranaceam continuantur. Sic lamina superior (Fig. I, II et III B—E) laminaque inferior (Fig. II et III, B′—E), ex quibus lamina spiralis membranacea originem ducit, exsistunt, inter quas laminas fasciculi nervei ex libero laminae spiralis osseae margine prodeuntes situm obtinent. (Fig. II et III, c.)

Quod *Corti*[18]) laminam spiralem membranaceam ex sola laminae spiralis osseae superficie vestibulari exoriri contendit, ejus erroris causa inde repetenda videtur, quod ille scrutator segmentis transversis usus non est, quibus adhibitis, facile tibi de laminae inferioris praesentia persuadere possis.

Duae laminae pari semper intervallo a testae cochleae pariete inter se coalescunt (Fig. I, II et III, E). Eo magis ratio, quae laminis et inter se ipsas et cum partibus vicinis intercedit, in diversis gyris, ubi hi ortum capiunt, variatur. Lamina inferior semper a libero margine lamellae osseae oritur, ideoque tanto latior exsistit, quo haec cupulam versus angustior evadit (cf. B′—E. in Fig. III et II.); superior contra, ad cochleae basim fere tota sua latitudine lamellae osseae imposita, hic periostei vice fungitur. (Fig. III.

18) l. c. pag. 9.

B—E). Eo autem, quod ad cochleae apicem versus lamina spiralis ossea angustior angustiorque exsistit, lamella superior fundamento suo osseo magis magisque privatur (cf. Fig II, B—E), ut postremo ei jam imposita non sit, sed, aeque atque inferior, a libero lamellae osseae margine originem capiat. Sic ambae lamellae, quibus lamina spiralis membranacea ortum debet, ad postremum unius ejusdemque sunt latitudinis. Cui rei convenit, quod massa nervea, inter laminae spiralis lamellas interposita, ad cupulam versus magis magisque ex involucris suis osseis provenit, eoque majore spatio periosteo continuato circumdatur.

Quae periostei continuatio in facie inferiore lamellam tenuem, textura fibrosa instructam, efformat, ad quam lamellam a lamina ossea transitus tam paulatim fit, ut in praeparato ope acidi muriatici tractato non nisi difficulter limitem utramque dirimentem internoscere possis (Fig. II et III, B′). In facie superiore autem periosteum continuatum tum forma tum constitutione mutatur. Primum enim superior lamellarum, ex quibus lamina spiralis membranacea exoritur, colore fusciore excellit, quo quidem a periosteo ipso, partem interiorem versus sito, atque a subjecta ipsi laminae spiralis osseae lamella plane discerni potest (Fig. I et II, B—C); deinde substantiam incrassatam offert, quae incrassatio, postquam in singulis cochleae gyris majorem minoremve gradum attigit, sensim deminuitur atque in processum excurrit, qui, si a latere intuearis, ad rostri similitudinem accedit. Qui processus (Fig. I, C′—D; Fig. II et III, D), crista spiralis acustica s. labium vestibulare ab ***Huschke*** dictus, a parte inferiore sulco s. semicanali spirali, ab ***Huschke*** nuncupato (Fig. I, f., Fig. II, C), limitatur. Cujus sulci marginem inferiorem continuata lamella superior laminae spiralis membranaceae constituit, quae, exigua crassitudine praedita, ad peripheriam versus sese confert (labium tympanicum ab ***Huschke*** nominata) (Fig. I et II, C—E), ubi postquam cum lamella inferiore coaluit, superficiei internae parietis conchae affigitur.

Substantia incrassata, de qua memoravimus, in cochleae basi aliquanto magis in oculos incurrit, quam in apice, quippe quae, quo liberius, lamina spirali ossea recedente, in cavum cochleae prominet, eo magis volumine decrescat. Itaque, si

ejus totam continuitatem contemplamur, speciem praebet tori, lineae spiralis ad instar curvati, qui, laminae spiralis membranaceae initium limitans, a parte inferiore ad superiorem versus latitudine atque altitudine magis magisque minuitur. Cujus tori latitudo, auctore *Corti* [19]), in cochleae basi 0,09‴, in parte media 0,06‴, in apice 0,048‴ aequat. Crassities ejus ab hoc observatore non satis accurate definita est; aequat enim in gyro primo minimum 0,036‴, eodemque modo sursum versus deminuitur. Totius substantiae volumine decrescente, etiam singulae partes, id quod per se elucet, pro rata parte minuuntur, quo fit, ut et crista spiralis acustica et sulcus spiralis infra decurrens brevior angustiorque evadat. —

Labium vestibulare, siquidem id diligentius consideres, non simpliciter crista spiralis continua apparet, sed potius compluribus incisuris, regulatim altera juxta alteram dispositis, in totidem processus divisum est, qui, si a facie superiore eos adspicias, formam oblongam quadrangulam praebent ac primo ab *Huschke* [20]) denticuli auditorii, tum a *Corti* [21]) „dents de la première rangée" nuncupati sunt. Quos si a latere intuearis in segmentis perpendicularibus secundum laminae spiralis latitudinem effectis, eos rostri speciem, in describenda crista jam commemoratam, prae se ferre i. e. a basi lata incipere atque in apicem curvum exire, cognoscas. Singuli dentes incisuris illis alter ab altero omnino disparati sunt, id quod facillime eo nobis persuadere possumus, quod, superficiem a parte superiore intuentes, duos eorum inter se discedere atque sulcum triangularem inter semet relinquere, vel, id quod interdum in segmentis transversis observatur, alterum alteri superimpositos videmus (Fig. III, f.). A facie superiore contemplantibus dentium apices paulo latiores, quam pars reliqua, apparent (Fig. I, D.). Haec pars reliqua, teste *Corti* [22]), in cochleae gyris primo secundoque 0,004‴ aequat, dum finis liberi latitudo 0,005‴

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19) l. c. pag. 11.

20) *Huschke*, Ueber die Gehörzähne in: *J. Müller's* Archiv etc. Jahrgang 1835. pag. 335.

21) l. c. pag. 11.

22) l. c. pag. 12.

est. In gyro semitertio haec exstat ratio 0,003‴ : 0,0035‴. Longitudo latitudini conveniens 0,028‴—0,02‴ aequat. Quibus etiam congruunt mensiones a me ipso institutae, nisi quod, crassitudinem si respicias, iis, quae *Corti* affert, adsentiri non possum. Namque, dum *Corti* crassitudinem denticulorum in basi 0,003‴, ergo 0,001‴ minorem, quam latitudinem, esse affirmat, equidem semper crassitiem aliquanto majorem, quam latitudinem, observavi. His etiam concinit delineatio a *Kölliker* [23]) prolata. Quantum mea fert opinio, dentium crassitudo omnino certo definiri nequit, tum quia in unaquaque parte alia est, tum quia incisurae inter denticulos interjectae in facie superiore ultra summam sulci spinalis curvaturam prominent, ideoque, ubinam denticulorum initium sit, difficile est statuere. Quod a *Corti* non videtur observatum esse; saltem nulla ejus rei mentio infertur.

Incisurae, de quibus diximus, binis denticulis inter se disparatis, non desinunt, sed potius deorsum versus in semicanale spirali forma sulcorum continuantur, qui sulci etiam per labium tympanicum extenduntur (Fig. I, g). Quo fit, ut et sulcus spiralis et labii tympanici superficies speciem aequabiliter striatam offerat, quae in praeparatis talibus, in quibus has partes a latere intueri licet (Fig. III.), manifesto cognoscitur.

Hos sulcos usque in mediam semicanalis spiralis partem pertinere, jam *Claudius* [24]) vidit, cui scrutatori tamen equidem non possum quin contradicam, eos labium inferius non adsequi disertis verbis contendenti, quum e contrario eos per totam hanc partem extendi saepe observaverim.

Quod ad telam ejus partis laminae spiralis membranaceae, quam hucusque descripsimus, attinet, jam memoravimus, eam pro periosteo directe continuato habendam esse. Neque non supra jam attulimus, lamellam inferiorem indolem suam fibrosam servare, dum superior mutationem subeat. Haec enim naturam cartilagineam accipit. Consistit tum e massa quadam fundamentali hyalina, quae tantummodo hic

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23) l. c. pag. 749.

24) *M. Claudius*, Bemerkungen über den Bau der häutigen Spiralleiste der Schnecke in: *Siebold* und *Kölliker's* Zeitschrift für wissensch. Zoologie. Vol. VII. fasc. 1 et 2 pag. 155.

illic fibrosa apparet atque cellulas passim inspersas offert. Quae cellulae, speciem oblongam vel subrotundam, at plerumque fusiformem praebentes, in substantiae incrassatae parte inferiore mediaque tum magno numero tum aequabiliter in massam fundamentalem hyalinam immersae cernuntur (Fig. II et III). — Verumtamen liberos margines versus rariores rarioresque exsistunt, neque totam substantiam penetrant, sed tantum compluribus seriebus altera juxta alteram positae inveniuntur. Quo modo dispositae cellulae etiam in interstita, inter dentes auditivos interjecta, intrant, ita tamen, ut non ad ipsos dentium apices progrediantur (Fig. I, c). Similiter cellulae per series dispositae in tota superiore zonae cartilagineae facie in conspectum veniunt (Fig. I, c), ubi quidem, massam fundamentalem circumdantes, series vel catervas satis regulares, forma oblonga vel subrotunda praeditas, constituunt (Fig. I, b). Quae figurae, prope dentes in longum extractae, semper parallelum longitudini dentium decursum ineunt, interdumque, furcarum ad instar diffissae, tum ad modiolum tum ad peripheriam versus tendunt. Cellulae, quo longius a dentibus absunt, eo plures in superficie apparent, eoque breviores et rotundiores figurae, iis limitatae, fiunt. Nunquam vero ad eandem altitudinem, quam massa fundamentalis hyalina obtinet, adscendunt, sed semper in sulcis interpositis jacent, qua causa *Corti*[25]) adductus fuit, ut laminae spiralis membranaceae partem, de qua nunc agitur, habenulam sulcatam (Bandelette sillonée) et prominentias in ea obvias excrescentia cylindracea (Excroissances cylindriques) appellaret.

Antequam progrediar, striae cujusdam lucidae mentio injicienda est, quae, si harum partium superficiem desuper adspicias, in interno dentium margine directione eorum margini externo parallela reperitur (Fig. I, d—d′). Quae stria lucida neque a forma neque a substantia habenulae sulcatae mutata pendet, sed tantummodo ad radiorum lucis refractionem in sulco spirali referenda est, quam ob rem respectu anatomico non magni momenti apparet.

Dentes auditivi eadem massa fundamentali hyalina consi-

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25) l. c. pag. 11 et 12.

stunt, quae in habenula sulcata inest, eamque velut continuant. Sunt omnino hyalini atque pellucidi, et, desuper adspecti, nullam ne minimam quidem structuram praebent. Contra ea in segmento transverso parallela sulci spiralis curvaturae directione fibras tenues decurrere cognoscas, quae et sursum in dentes auditivos (Fig II, C—D.) prominentiasque cylindraceas et deorsum in labium tympanicum transeunt. (Fig. II, C—E).

Certe jure ac merito mediam habenulae sulcatae portionem cartilagineam appellare licet, quippe quae ex cellulis substantiaque fundamentali rigida inter cellulas interposita consistat. Ad dentes auditivos labiumque tympanicum versus natura telae conjunctivae propria ex substantiae intercellularis indole fibrosa ejusque natura molli atque elastica planius cognoscitur. Ejusmodi telae alterius in alteram transitus tempore recentiore satis superque probatus est, ex quo primus omnium ***Reichert*** earum telarum inter se cognationem ostenderat nomineque germanico „Gewebe der Bindesubstanz" plures partes morphologicas, quae ad id tempus pro omnino diversis habitae fuerant, comprehendendas esse docuerat. Aetate recentiore ***Virchow*** eandem rem novis demonstravit argumentis, ita ut nuperrime et ipse ***Kölliker***[26]) hanc rei contemplationem acceperit, quamvis antea acerrime contra eam dimicavisset.

Ad ea, quae hucusque protulimus, si adjeceris, calcariae salibus ope acidi muriatici diluti ex lamina spirali ossea amotis, hujus telam telae habenulam sulcatam constituenti adspectu tam similem exsistere, ut tantum colore lucidiore differat, dum singula utriusque partis elementa morphologica quam maxime inter se congruunt, sententiae ei, qua habenula sulcata e cartilagine consistere creditur, tanto plus adminiculi praebetur. Quod imprimis ad globulos spectat, qui in hujus zonae superficie per series alter juxta alterum positi cernuntur (globules, qui remplissent les sillons), de quorum quidem natura ***Corti***[27]) dubitanter disserit, omnis dubitatio vero vel eo tollitur, quod haec elementa in substantiae parte in-

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26) Handbuch der Gewebelehre. 2. Aufl. Leipzig 1855. pag. 52 seqq.
27) l. c., pag. 42.

teriore inveniuntur. Quod vero species fusiformis in ejus superficie minus plane cognoscitur, hujus rei causa, quemadmodum *Claudius*[28]) recte judicat, in eo quaerenda est, quod hoc loco eorum axes longissimi directione perpendiculari ad laminam spiralem osseam spectant. Quo praeterea addamus oportet, hos globulos nunquam tam regulari forma rotunda praeditos tamque congruenter alterum juxta alterum positos esse, quam *Corti* eos delineaverit, sed potius persaepe vix cognosci posse, ac tantum linearum fuscarum, prominentias substantiae fundamentalis limitantium, speciem offerre. Imprimis in segmentis transversis, quamvis eorum magnam multitudinem paraverim, nunquam mihi contigit, ut globulum deprehenderem, globulis, quos delineatio *Corti* ostendit, consimilen.

Habenulam sulcatam hic illic vasa capillaria, in quorum parietibus nuclei sparsi plane animadvertuntur, permeant. Quae vasa partim a periosteo, vasis abundante (fig. I, a), partim a lamina spirali ossea originem ducentia majore ex parte ad peripheriam versus tendunt, ramulis tamen etiam ad partem superiorem atque inferiorem dimissis, qua in re fasciculis nerveis, in laminam spiralem inclusis, non interrumpuntur, sed potius eos perforant (fig. II, a).

Porro monendum videtur, quo modo optime contingat, ut superiorem habenulae sulcatae faciem plane intueri liceat. Hunc in finem enim ratio optima haec est, ut in habenulam sulcatam solam per se, a subjecto strato nervoso atque ab inferiore lamellarum, ex quibus lamina spiralis membranacea ortum habet, separatam inquiras. Quae separatio facile efficitur, si, acu tenui inter duas lamellas laminae spiralis acido muriatico tractatae introducta, eas sensim distraxeris. Lamella inferior semper in fine extremo resolvitur, qua in re, quum plerumque etiam stratum nervosum removeatur, habenula sulcata ad instituendam observationem multo pellucidior redditur.

Haec fere nobis admonenda videbantur de illa laminae spiralis membranaceae parte, quae, antea nomine zonae coriaceae, zonae cartilagineae etc. appellata, nuper habenula sulcata nuncupata est.

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28) l. c. pag. 156.

Jam ad describendam partem alteram laminae spiralis membranaceae, nempe ad zonam membranaceam, uti a *Scarpa*, *Breschet*, *Huschke*, *Weber*, *Bendz*, *Todd* et *Bowmann*, *Hannover* nominatur, vel ad habenulam denticulatam zonamque pectinatam, a *Corti* dictam, quae quidem ad finem nobis propositum multo gravioris momenti est, transire liceat.

Facere non possum, quin admoneam, omnes illas divisiones respectu anatomico non satis idoneis argumentis fultas esse. Namque nulla earum naturalem limitem inter dictas laminae spiralis membranaceae portiones constituit. Unde fit, ut labium tympanicum, quod, uti supra vidimus, ad cupulam versus latitudine magis magisque augetur, ab auctoribus illis nunc majore nunc minore ex parte ad externam zonam membranaceam trahatur, quamvis ne unum quidem ejus punctum afferri possit, in quo talis separatio ratione nitatur. Idem incommodum in discrimine, quod *Corti* inter habenulas sulcatam et denticulatam statuit, recurrit. Qua in re inferior laminae spiralis membranaceae lamella a nullo auctorum modo allatorum respicitur. Me judice, siquidem omnino separatio facienda est, limes tantummodo eo loco statui potest, quo duae lamellae, ex quibus lamina spiralis membranacea orta est, ad unam laminam conformandam conjunguntur. Quodsi equidem adducor, ut ab ipso initio divisiones antea prolatas, utpote quae nulla ratione anatomica innitantur, rejiciendas esse judicem, at nihilosecius in mea ipsius descriptione easdem sequar, hujus rei causa in eo est posita, quod primum laminae spiralis membranaceae divisio ad finem meae disquisitioni propositum omnino exigui momenti est, tum vero metuendum erat, ne ad multa singularum partium nomina etiam nova alia adjicienda essent, ac tamen, ne perspicuitati officerem, veterum nominum enumeratione supersedere non possem.

Laminae spiralis pars, quae hucusque membranacea dicitur, neutiquam simplex membrana est, sed canalem constituit (fig. II. D C E F G.), duabus membranis decursum inter se parallelum tenentibus a parte superiore et inferiore limitatum, cujus canalis paries internus sulco spirali (C), externus pariete testae cochleae (G—F) formatur. Membrana, quae huic canali tegendo inservit, inter dentium auditorio-

rum apicem internamque cochleae parietis superficiem extensa est (D—G). Canalis fundus partim labio tympanico partim membrana, quae labio tympanico lamellaque inferiore inter se coalitis exorta in cochleae parietem abit, atque, praeeunte *Claudio* [29]), ut a membrana superiore distinguatur, apte membrana basilaris (fig. I et II, E—F) appellari potest, construitur.

Quem canalem pro eodem habendum esse censeo, quem *Reissner* [30]), vir doctissimus, canalem cochlearem nominat, quamvis ille scrutator, ne hoc fiat, diserte admoneat. Nam nunquam mihi contigit, ut in segmentis transversis plures animadverterem membranas, quam duas illas alteram supra alteram decurrentes atque ad cochleae parietem versus porrectas. Nec unquam in zona cartilaginea praeter membranas supra allatas tertiae originem invenire potui. Quod quum ita sit, spatio descripto nomen canalis cochlearis imponam. Cujus fundus haec sibi peculiaria vindicat.

Semicanalis spiralis sulci, uti jam admonuimus, in superiorem labii tympanici faciem transeunt. Hi sulci, quo magis ad partem externam conversi sunt, eo magis evanescunt, ideoque, quo propius cupulam lamina spiralis membranacea pervestigatur, eo difficilius conspiciuntur. Brevi autem spatio ante locum eum, quo labium tympanicum cum lamellula inferiore coalescit, semper rursus plane animadvertuntur. Hoc loco in unoquoque sulco foramen est, quo labium inferius perfecte perforatur (fig. I, h. fig. III, e). Quae foramina tam regulari serie inter se connexa sunt, ut plane in linea spirali posita videantur. Pariter intervalla inter foramina interjecta per totam laminam spiralem membranaceam paene inter se paria sunt, nec nisi ad cochleae apicem versus paulo minora exsistunt. Semper vero foramina incisuris inter dentes auditorios interpositis respondent, qui dentes et ipsi ad cupulam versus paulo angustiores apparent. Quae ratio computando facile eruitur. Ad certum laminae spiralis membranaceae spatium, quale fere inter fila araneo-

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29) l. c. pag. 154.

30) l. c. pag. 425.

rum microscopii, quae vocantur, oculo offertur, semper par incisurarum inter dentes interjectarum foraminumque dictorum numerus pertinet. Si quando in perlustrando certo laminae spiralis spatio foraminum paulo major invenitur multitudo, quam incisurarum, tum causa in eo quaerenda est, quod labium tympanicum, e nexu cum partibus lateralibus solutum, in foraminum regione jam mera indole membranacea accepta, sub lamella vitrea, ipsum obtegente, perfacile corrugatur, quo fit, ut foramina propius alterum alteri admota esse videantur, dum hoc de dentibus auditivis, quippe qui substantia solidiore consistant, evenire nequit.

Quae foramina in primo cochleae gyro membranam directione paene verticali perforant, attamen, quo propius ad modioli apicem accedunt, situm eo obliquiorem obtinent, qua re canaliculos efformant parvulos, longitudine magis magisque accrescentes labiumque inferius a parte inferiore sursum versus obliqua ad peripheriam directione penetrantes, quorum apertura superior ab inferiore longius longiusque discedit. Quos si in inferioribus cochleae regionibus contemplaris, verarum formae ovatae aperturarum speciem praebent, dum in regione cochleae superiore vix canaliculi breves cognoscuntur, quoniam duae aperturae parum inter se respondent. Solummodo eorum ratione, qualem in his partibus offerunt, probe cognita, contingit, ut duas aperturas invenias decursumque per membranam pellucidam persequaris. — Quas aperturas exstare quam evidentissime nobis persuadere possumus, si in parandis segmentis transversis obtigerit, ut, id quod rarissime fit, cultrum per ipsum foramen ducamus. Quo facto labium tympanicum directione magis minusve obliqua perforatum esse planissime cognoscas.

Foraminum inter se distantia in gyro secundo 0,004''' aequat. Unde totus eorum numerus computando erui potest. Etenim, quum lamina spiralis membranacea in fele minimum 10''' longa sit, in ea 2500 talium foraminum exstant; cui numero dentium auditivorum multitudo respondet.

Ad externam foraminum partem labium tympanicum cum lamella inferiore coalescit, qua re, quum substantia incrassetur, prominentiae, inter foramina in sulcis sita interjectae, magis etiam in oculos incurrunt, ita ut dentes ap-

parentes (dents apparentes), quos *Corti*[31]) descripsit, exsistant (fig. I, II et III, E). Qua de re si *Claudius*[32]) haec verba profert: „Von der Unterseite des Aussenrandes der Unterlippe, dicht (nach aussen) an den Löchern geht eine schmale Platte nach unten und innen hinab, an welche sich das die Unterseite der knöchernen Spirallamelle überziehende Periost anschliesst. Diese Platte ist ein Theil der Crista, indem sie fest mit derselben zusammenhängt und aus derselben knorpelartig zähen Substanz besteht, wie jene etc.“, hoc laminae (Platte) nomine nihil aliud dicitur, nisi locus, quo duae lamellae inter se conjunguntur (fig. II. et III, E).

Quod attinet ad rationem, quae huic parti cum lamina spirali ossea intercedit, ea in omnibus cochleae gyris extra laminae spiralis osseae marginem sita, neque vero, uti *Corti*[33]) affirmat, in modioli basi in eam imposita est, quod si foret, per se intelligitur, lamellarum conjunctionem exstare non posse. Cujus loci a sulco spirali distantia videlicet directa ratione cum latitudine labii tympanici continetur, atque, auctore *Corti*[34]), in modioli basi 0,01‴, in ejus parte media 0,03‴, in apice 0,04‴ aequat. Quod quum ita sit, hic locus in initio primi cochleae gyri tam prope habenulam sulcatam positus est, ut foramina dentibus auditivis superentur atque tegantur, ad partem superiorem autem magis magisque in conspectum veniant.

Postquam, duabus lamellis inter se coalitis, membrana basilaris exorta est, haec ad cochleae parietem versus continuata in ejus periosteum transit (fig. I et II, E—F). Est omnino structurae expers atque hyalina summaque pelluciditate praedita, neque vel diligentissime intuenti ullum cellularum vel nucleorum, quae antea adfuerint, vestigium offert (fig. III, i). Dimidium ejus exterius (fig. I, G—F) ab interiore (fig. I, E—G) eo discrepat, quod, dum hoc indolem omnino aequabilem ostendit, ipsum plicas tenuissimas praebet. Quas plicas *Hannover*[35]) falso pro veris fibris

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31) l. c. pag. 14.
32) l. c. pag. 156.
33) l. c. pag. 14.
34) l. c. pag. 15.
35) l. c. pag. 60.

habuit; *Corti* [36]), qui hanc plicatam membranae basilaris portionem nomine zonae pectinatae appellat, has plicas in media ejus parte luculentissime apparere affert.

In portione membranae basilaris non plicata, per totam ejus longitudinem a parte inferiore sursum versus, vas capillare parallela cochleae parieti directione decurrit (Fig. I, 0), quod primus omnium *Huschke* [37]) vas spirale nominavit. Quod vas neutiquam, uti *Corti* [38]) testatur, membranae basilaris faciei, ad scalam tympani conversae, simpliciter adjacet, sed potius in ea est positum, veluti inter duas lamellas inclusum. (Fig. II, 0). Quae res causae fuit, cur *Corti* huic vasi in cochleae gyris primo secundoque duplices parietes esse contenderet. Quod quamvis eatenus verum sit, quod membrana basilaris quasi vaginam vasi recipiendo efformat, tamen nequaquam ita intelligendum est, tamquam vas, quemadmodum *Corti* arbitratur, suum ac proprium involucrum, quo paries interior cingatur, habeat. Quodsi vir clarissimus rationem commemoratam in gyro semitertio exstare negat, id inde repetendum est, quod, quum hoc loco vasis lumen minus sit, duplices lineas extremas internoscere difficilius est.

Hoc cum ipsius viri docti verbis concinit, quippe qui haec confiteatur [39]): „Je n'ai pas encore pu observer le passage du capillaire à doubles parois dans celui à parois simples, qui se trouve dans le sommet du limaçon".

Ramulos a vase, de quo dicimus, emissos nunquam observavi.

Interdum alterum quoque vas, decursum vasi spirali parallelum tenens, in conspectum datur, quod, proxime ad exteriorem foraminum partem positum, cum vasis ex modiolo proficiscentibus communicat. Hoc vas, uti mihi videtur, laminam spiralem non per totam ejus longitudinem comitatur, neque omnino observatori tam constanter offertur.

Membrana basilaris ad cochleae parietem eo affixa est, quod in partem periostei ad cristae similitudinem incrassa-

36) l. c. pag. 21.
37) l. c. pag. 887.
38) l. c. pag. 19.
39) l. c. pag. 20.

tam transit, quae pars crassior, quemadmodum jam supra commemoravimus, laminae spiralis osseae decursum sequitur. Hic processus (Fig. I et II, F), qui ab *Huschke* lamina spiralis accessoria, ab *Todd* et *Bowmann* musculus cochlearis, a *Kölliker* ligamentum spirale nuncupatur, naturae respectu habito, tam diligenter perquisitus est, ut non habeam, quod praeterea adjiciam. In apice suo fibras manifestas ostendit, quae ad periosteum versus porriguntur et, auctore *Kölliker*[40]), in ipsum periosteum pergere videntur. In crassiore sua parte, magis exteriora versus sita, hic processus naturam fibrosam minus plane ostendit, quippe qui in hac parte cellulas, specie rotunda vel oblonga ac fusiformi praeditas, in massam immersas offerat. Fibrarum muscularium in hac regione nullum vestigium deprehendere potui, qua de causa, quod ad processus naturam attinet, facere non possum, quin cl. *Koelliker*, cum tela conjunctiva consistere consenti, assentiar.

Jam partes eas, quae supra membranam basilarem i. e. in canale cochleari positae sunt, contemplari liceat. Canalem cochlearem recipiendo organo Cortiano inservire omnino apertum atque manifestum est. *Huschke*[41]), qui hoc organon fortasse jam ante observaverat, investigationibus in embryis institutis, in quibus se epithelium cylindraceum specie conica praeditum animadvertisse ait, ad quod usque primitivae nervi cochleae fibrae decurrere viderentur, quique per hoc epithelium cylindraceum forsan fibras nerveas via maxime directa sono incitari suspicatur, ipse tamen ex parte altera haud diffitetur, in animalium jam evolutorum cochleis has partes a sese nunquam animadversas esse. Ceterum hae partes ab *Huschke* tam manco atque imperfecto modo descriptae sunt, ut anatomia microscopica demum praeclarissimis atque accuratissimis *Corti* observationibus earum cognitione sit locupletata.

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40) Microsc. Anat. pag 758.

41) l. c. pag. 885.

Organum Cortianum, quod ipse vir doctus „dents de la deuxième rangée" appellat, tale est *).

Proxime supra superiores canaliculorum labium tympanicum perforantium aperturas ad partem exteriorem superioremque versus series bacillorum hyalinorum, forma cylindracea eademque, qua aperturae sunt, diametro praeditorum, assurgit (Fig. I, i.). Quodque horum bacillorum (Fig. II, i.) in intumescentiam triangularem (h.) cellulae similem transit, quae, desuper considerata, nucleum circularem continere videtur. Sin, segmento transverso in usum vocato, a latere adspexeris, hunc nucleum nunquam animadvertas. Bacilla quum maxime inter se conferta sint, hae intumescentiae a latere comprimnntur, unde fit, ut speciem complanatam accipiant. Fortasse etiam forma triangularis hinc dependeat. In latere extremo unaquaeque harum intumescentiarum rursus decrescit atque in bacillum hyalinum, forma cylindracea instructum, mutatur. Hoc bacillum deorsum ad membranam basilarem versus flectitur, indeque, figura S. litterae latinae efformata, sursum adscendens denique, crassitudine paulatim adaucta, specie parallelopipedi brevis finem capit (Fig. I et II, k.). Transitus in hanc partem extremam non curvatura paulatim ac leniter facta, sed angulo obtuso evenit, quoniam pars extrema situm membranae parallelum tenet, bacillo, quod ex membrana attollitur, angulum cum ea formante.

Bacilla, de quibus agitur, a *Corti*[42]) „branche postérieure ou interne des dents de la deuxième rangée" finisque eorum exterior crassiorque, veluti pars separatim exstans „coin postérieur ou interne" appellatur. Equidem duas has partes conjunctim nomine b a c i l l o r u m p r i m i o r d i n i s appellabo. Quae si *Corti* partem exteriorem versus e prominentiis, quas „dents apparentes" vocat, proficisci contendit, haec quidem res, quum ad eam dilucidandam nonnulla praemitti oporteat, postea elucebit.

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*) A d n o t a t i o. Hi ordinis secundi dentes *Corti* adduxerunt, ut membranae basilaris partem illis subjectam nomine habenulae denticulatae diceret.

42) l. c. pag. 15.

Bacillorum primi ordinis longitudo, quae, teste *Corti*[43]), in cochleae parte inferiore mediaque 0,0174‴, in superiore 0.0194‴ aequat, secundum meas mensiones in cochleae apice, 0,03‴ est. Finis interioris intumescentia, auctore *Corti*, 0,003‴ — 0,004‴, exterioris 0,003‴ lata est; equidem illius latitudinem 0,002‴, hujus 0,0024‴, aequare vidi*).

Primi ordinis bacilla ad peripheriam versus alterum ultra alterum non prominent, sed eorum fines lineam spiralem constituunt, quae supra membranam basilarem decurrit. In hac linea directo cum exterioribus bacillorum primi ordinis finibus contactu secundus talium bacillorum ordo (fig I et II, l—m), ad parietem cochleae decurrens, initium capit, qui, ad texturam quod attinet, cum priore omnino congruens, solum exiguas formae diversitates ostendit.

Unumquodque horum bacillorum, a fine interiore eoque crassiore, qui pariter atque bacillorum primi ordinis finis exterior, parallelopipedi, (fig I et II, l), quamvis paulo brevioris, speciem praebet (coin antérieur ou externe a *Corti* sic dictus) ac pariter situm membranae basilari parallelum tenet, incipiens, dum deorsum ad membranam versus flectitur, indolem cylindraceam accipit. Simul, quo loco inflexio initium capit, quae quidem in hoc fine lenior est ideoque minus angulosa apparet, quam in fine exteriore bacillorum primi ordinis, voluminis deminutio incipit, qua paulatim sensimque adaucta, tale bacillum, ubi ultimus ejus quadrans initium habet, ad dimidiam ambitus sui partem jam decrevit. Inde ab hoc loco bacillum rursus, attamen sola latitudine,

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*) Adnotatio. Ego quod non solum hoc loco, sed etiam supra atque infra neque omnes mensiones, a Corti institutas, in meis disquisitionibus repetivi, quippe qui tum modo mensurationes iteraverim, si observationum a viro docto factarum eventus cum iis, quae ipse videram, minus concinere videbatur, neque omnes dimensiones singularum partium a Corti allatas commemoravi: hujus rei causa in eo reposita est, quod tum ob egregiam, qua hic scrutator excellit, diligentiam ejus observationibus omnino confidere licuit, tum ad finem meae commentationi propositum certe inutile videbatur, omnes dimensiones tam exacte atque anxie afferri.

43) l. c. pag. 45.

augetur, dum crassities deminuitur, quo fit, ut a parte superiore deorsum versus compressum appareat cuneoque, qui latior latiorque existat atque acuminetur, comparari possit. Finis quasi membranaceam indolem accipit atque cum membrana basilari coalescit (Fig. I et II, m). — Bacilla modo descripta a *Corti* „branche antérieure ou externe des dents de la deuxième rangée" appellata sunt. Bacilla secundi ordinis bacillis ordinis primi paulo longiora, auctore *Corti*[44]), in cochleae basi 0,0244‴ — 0,0264‴, in parte media 0,0284‴ — 0,0304‴, in apice 0,0354‴ longitudine aequant. Finis eorum interioris latitudo secundum meas mensiones 0,0036‴ est.

Duorum ordinum bacilla altera tam prope altera posita sunt, ut partibus suis latioribus inter se contingant. Sic coni articulares, quos *Corti* dicit, duarum catenarum, linea spirali porrectarum, speciem prae se ferunt.

Organi Cortiani descriptio, quam proposui, a priorum auctorum observationibus his rebus discrepat.

1. Organum Cortianum, quale hucusque ab omnibus descriptum atque delineatum est, in longum porrectum atque membranae basilari parallelum apparet, dum equidem semper id arcus ad instar super membranam curvari observavi, qua in re bacilla flexuram illam supra descriptam ad S litterae latinae similitudinem accedentem offerebant (Fig. II, i h k l m.) Cujus rei aliud argumentum afferre non possum, nisi quod in nullo praeparato, sive recenti sive acido muriatico vel sacchari solutione etc. tractato, sive bacilla etiamtum cum membrana basilari cohaerebant sive ab ea jam sejuncta erant, unquam aliam rationem observare licuit. Curvatura enim si arte esset producta, eam in tanta praeparatorum, in quae inquisivi, multitudine semel saltem varietatem aliquam praebere necesse fuisset. Ex altera parte intelligi nequit, quomodo factum sit, ut organum Cortianum, dum aliis re-

44) l. c. pag. 45.

ctum appareret, quotiescunque ego observarem, speciem curvatam praeberet. Causa magis etiam idonea in eo est reposita, quod hoc organum, uti infra videbimus, ab utroque fine fixum, quum majore sit extensione, quam interstitium inter haec duo puncta interpositum, arcus speciem induat necesse est. Quodsi, organum Cortianum inde a facie superiore contemplatus, jam ex luminis diversitate cognoscere possis, mediam illius partem altius esse sitam, quam duos fines, hoc luculentius etiam tum apparet, si vel bacillorum ordines, id quod crebro evenit, pressu microscopii lamella obtegente exhibito, ad latus versus flectuntur, vel in segmentis transversis per laminam spiralem considerantur. *Claudius* [45]), quantum ex una delineationum ejus suspicari licet, hanc rationem jam animadvertisse videtur, quamquam in commentatione sua nullam de ea mentionem injicit.

2. Non facere possum, quin certissime negem, organum Cortianum e quattuor membris compositum esse, quoniam duo membra intermedia a viro docto memorata non sunt nisi bacillorum ordinis primi et bacillorum ordinis secundi fines latiores inter se contingentes. Neque minus ullam in hoc organo articulationem exstare infitior. *Corti* enim, quum non animadvertisset, conos articulares, quos vocat, in alia sitos esse planitie atque reliquam bacillorum partem ideoque cum hac parte angulum efficere, qua re talis imago offertur, quasi complura membra adsint, in errorem inductus est. Qui si sententiae suae adminiculum inde petit, quod bacilla tantum his membris intermediis se flectendi facultate utantur, qua quidem de re talia verba profert [46]): „Je leur ai donné la dénomination de coins articulaires, c'est principalement au moyen d'eux, que les deux branches des dents de la deuxième rangée peuvent se plier, et surtout de haut en bas", primum in eo fallitur, quod inflexionem imprimis in articulationibus, quas dicit, fieri contendit. Etenim nos ipsi bacilla multo crebrius in quavis alia parte tenuiore modo abnormi

45) l. c. Tab. IX. Fig. 2.

46) l. c. pag. 16.

reflecti vidimus. Praeterea autem *Corti* in ea re errore ducitur, quod rationem omnino normalem, nimirum bacillorum ad partem inferiorem versus flexionem in S litterae formam, pro abnormi habet. — Unus tantum auctor, nempe *Harless*[47]), articulationem hoc loco exstare negat, potiusque immobilem partium inter se conjunctionem statuendam esse censet. Is jure admonet, bacilla saepe ita distrahi, ut pars cum fine, de quo agitur, conjuncta maneat, nec non planities, quae dicantur, articulatione praeditas vero articulorum motui parum idoneas esse. — Bacillis ad latus versus flexis, conos articulares omnino bacillis cylindraceis continuos esse elucet. Denique articulatio prorsus inutilis foret, quoniam neuter organi Cortiani finis liber est.

3. Ex mensionibus partium extremarum bacillorum ordinis primi secundique inter se conterminarum apparet, quum bacilla ordinis primi angustiora sint, simulque duo ordines utrimque alter proxime alterum positi cernantur, bacillorum ordinis primi numerum majorem esse, quam bacillorum ordinis secundi.

Quodsi *Corti*[48]) de conis articularibus haec ait: „Ils sont parfaitement égaux et ils ont une largeur de 0,0030‴ sur une longueur de 0,0044‴, tum de latitudine tum de longitudine eorum errat. Namque vel solus adspectus nos docet, singula bacilla ordinis secundi nequaquam singulis bacillis ordinis primi ita respondere, ut haec illis directe continuare videantur, sed potius nunc bacilla illa horum parti extremae opposita sunt, nunc singuli coni anteriores, quos *Corti* dicit, ei loco, quo bini coni posteriores conjunguntur, adnectuntur, nunc denique positio etiam magis irregularis est, id quod semper fiat necesse est, si diversae latitudinis membra arcte juncta una eademque linea inter se sunt opposita. De qua ratione certius etiam nobis persuadere possumus, si operam damus, ut in certo quodam organi Cortiani spatio haec extrema bacillorum membra ab utraque parte numeremus. Etenim numerando apparet, rationem inter

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47) *Harless,* Art. „Hören" in *R. Wagner's* Handwörterbuch der Physiologie. Vol. IV. pag. 445.

48) l. c. pag. 16.

conos anteriores et posteriores intercedentem eandem esse atque 2 : 3. Quem numerationis eventum in compluribus praeparatis nacti sumus. Exempla ut afferam, semel in uno eodemque spatio, quod conos posteriores 19 continebat, ferme 13 coni anteriores inerant, semel 24 conis posterioribus 16 anteriores respondebant, in praeparato tertio eorum ratio 12 : 8, in quarto 15 : 10 erat (cf. in Fig. I. seriem littera k. et seriem littera. l. denotatam). Quibus conorum latitudo, supra allata, quae directis mensionibus explorata est, convenit, quippe quae in bacillorum ordinis primi finibus 0,0024‴, in bacillorum ordinis secundi initiis 0,0036‴ aequet. Ceterum facere non possum, quin jam *Claudium* [49]) hac de re mentionem intulisse admoneam.

Conorum anteriorum longitudo paulo minor est, quam posteriorum; attamen haec res omnino exigui est momenti.

Ex conorum latitudine si bacillorum in tota membrana basilari obviorum multitudinem computaverimus, in fele, in qua quidem lamina spiralis membranacea 10‴ longa esse credatur, cochleam 4166 bacillorum ordinis primi et 2777 bacillorum ordinis secundi continere patet.

4. Ordinis secundi bacilla, ut mea fert sententia, directo in membranam basilarem transeunt. Interdum enim contingit, ut talia praeparata efficias, in quibus membrana basilaris epithelio ipsam obtegente omnino nudata sit. In ejus modi praeparatis, bacillorum ordinis secundi fines externos, qui sensim latiores et tenuiores evadunt, nequaquam ad membranam basilarem versus limitatos esse, sed directe in eam abire, apparet. (Fig. I. et II. m.). Porro, si bacilla, id quod saepe accidit, a membrana avelluntur, separatio interdum supra ipsum insertionis locum evenit, quo facto, fines divulsi in membrana prominentiarum regularium, uno ordine deinceps dispositarum, speciem praebent. Quamquam bacillorum avulsio plerisque in casibus ita fit, ut eorum nullum ne minimum quidem vestigium in membrana relinquatur, tamen hoc inde repeti potuerit, quod membrana e compluribus lamellis iisque tenuissimis consistat, qua-

49) l. c. pag. 158.

rum suprema simul cum bacillis amoveatur. Denique, si divulsos bacillorum fines ipsos consideramus, ii quidem formas quam diversissimas prae se ferunt, qua ex causa factum est, ut auctores normales horum bacillorum fines tam diversis modis describerent. Namque hi fines nunc angustiores, nunc latiores, nunc, uti *Corti*[50]) eos describit, bifurci, nunc cuneis similes, quales *Claudius*[51]) delineavit, nunc, ut verbis a ***Kölliker***[52]) prolatis utar, oblique abscissi, nunc acuminati, nunc lacerati cernuntur. Omnes hae formae in avellendo facile produci queunt.

Claudius[53]) in descriptione sua jam propius ad verum accedit, qui, bacillorum fines normales in membranam basilarem insertos esse contendens, tamen eos perfecte cum hac membrana coalescere non statuit.

5) Superest, ut rei cujusdam mentionem faciam, cujus, quum eam omnino negandam esse censeam, in descriptione proposita nullam omnino rationem habui. *Corti*[54]) enim in commentatione sua tres series cellularum epithelialium cylindracearum, quae imbricatim altera alteri superimpositae sint, describit. Quarum cellularum ternas in singulis ordinis secundi bacillis positas singulasque petiolo ad respondentes conos anteriores affixas esse affirmat.

Ad hanc rem quod attinet, sane super ordinis secundi bacilla cellulae epitheliales reperiuntur, quales omnino totum organum Cortianum liberamque membranae basilaris partem obducunt. Porro non possum, quin confitear, has cellulas in hac regione maxime regulatim per series dispositas esse, atque speciem magis ovatam prae se ferre, dum postea forma polygonia magis magisque praevaleat. Verumtamen, cellulas has epitheliales petiolis cum organo Cortiano connexas esse, nullo modo assentiri possum. Licet enim saepius talis offeratur imago, tamquam ex hisce cellulis petioli ad conos anteriores versus decurrant, tamen, si diligentius

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50) l. c. pag. 16.

51) l. c. Tab. IX Fig. 5.

52) *Kölliker*, Ueber die letzten Endigungen des Nervus cochleae und die Function der Schnecke 1854 pag. 8.

53) l. c. pag. 158.

54) l. c. pag. 17.

observaveris, pellucentia ordinis secundi bacilla huic errori ansam praebuisse cognoscas. Qui petioli si re vera exstarent, necesse foret, eos interdum, destrictis cellulis, quibus praeparatum obscuratur, cum organo Cortiano conjunctos conspici. Attamen, tale praeparatum ut efficerem, mihi quidem nunquam contigit. Quo addendum est, quod in conis anterioribus, licet et saepe et omnino plane in observationem veniant, tamen nunquam vel minimum locorum talium vestigium deprehendi potest, quibus divulsi cellularum petioli inserti fuerint. Quae quum ita sint, equidem adducor, ut hanc organi Cortiani partem exstare omnino negem. Regularis autem cellularum epithelialium supra bacilla dispositio a regulari partium subjectarum specie dependere credatur.

Denique quaedam generalia de bacillis adjicere liceat. Quod *Corti*[55]) contendit: „Quant à la préparation des dents de la deuxième rangée la condition principale et indispensable à remplir, est d'observer un limaçon tout chaud, savoir extrait d'un animal aussitôt qu'il a cessé de vivre," equidem neutiquam pro vero habere possum. Neque enim, si praeparatis vetustioribus utare, bacilla facilius disjunguntur, neque ipsa ullam mutationem subeunt. Itaque etiam ***Kölliker***[56]) contradicam oportet, qui ea telas admodum teneras et destructu facillimas esse tradit, quae acido muriatico modice diluto in usum vocato extemplo e conspectu evanescant. Equidem, quum me opinione supra exposita, a *Corti* prolata, in errorem inductum fuisse intellexissem, fere omnia, quibus usus sum, praeparata in diluto acido muriatico diversae concentrationis (e. g. 20 p. c.; part. singul. in part. mill.) asservavi, neque tamen unquam bacilla destructa esse vidi. E contrario, hac agendi ratione adhibita, bacilla manifestius, quam in statu praeparatorum recenti, se in conspectum dederunt. Neque magis, ut hae partes in forma sua naturali serventur, sacchari solutione opus esse observavi (pour maintenir ces objects délicats dans leur forme naturelle)[57]).

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55) l. c. pag. 46.

56) l. c. pag. 7.

57) l. c. pag. 47.

Quid est, quaeso, quod membrana basilaris, quae, judice *Corti*, eadem est constitutione chemica, non easdem commutationes subeat? Quid est, quod haec membrana nunquam ex observatoris adspectu sese subducat? Equidem, uti aperte confitear, utilitatem illam, quam *Corti* quibusdam agendi rationibus chemicis ad perquirendas apparatus auditorii partes prorsus recentes sibi allatam esse affirmat, cognoscere non potui.

Ex sulco spirali supra organum Cortianum stratum cellularum epithelialium usque ad internum cochleae parietem extenditur (Fig. I, p.). Quae cellulae non simpliciter altera juxta alteram collocatae, sed saepius imbricatim altera alteri superimpositae cernuntur. Quae ratio dum manifestius supra bacilla ordinis primi apparet, cellulae, uti jam supra memoratum est, supra ordinis secundi bacilla formam suam paullulum commutant, indeque, etiam in hac parte seriebus satis regularibus dispositae, in extremam membranae basilaris partem transeunt. Hic teneriores atque pallidiores apparent (Fig. I, p'.), quam cellulae magis introrsum versus sitae. Quae cellulae, auctore *Corti*[58]), speciem rotundam vel ovatam ostendunt; *Claudius*[59]) de iis haec ait: „Isolirt sind sie rund, in grössern Massen zusammenliegend platten sie sich gegen einander ab, und zeigen so eine helle Fläche, welche von sehr feinen und scharfen geraden Linien in eine Menge einzelner Felder getheilt ist, in denen dann die 0,003‴ grossen dunkeln Kerne liegen." Equidem eas non observavi nisi polygonias, quo in casu semper in majores catervas collectae erant. Supra ordinis secundi bacilla quod cellulae illae formam subrotundam prae se ferunt, quum numerus earum in hac parte non tantus sit, ut altera alteram complanare possint, nescio an ex observatione *Claudii* explicari queat.

Cellulas hasce canalem cochlearem totum explere, au-

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58) l. c. pag. 17.

59) l. c. pag. 156.

ctores, quos diximus, inter se consentiunt, eo tamen intercedente discrimine, quod *Corti* hoc tantum de uno cellularum strato, *Claudius* de compluribus contendit. Hoc enim testante, in sulco spirali primi cochleae gyri 3—5 strata cellularum istarum alterum alteri superimposita inveniuntur. Ego nunquam totum canalem cochlearem his cellulis repletum esse certo cognovi, sed potius semper unum cellularum stratum animadverti, reliqua canalis cochlearis parte „endolympha" impleta. Ceterum, quum in eam rem totam animi intentionem non adverterim, virorum doctorum observationem veram esse haud negaverim.

Canalis cochlearis, auctore *Claudio*, tum in vestibuli initio tum in cochleae apice omnino clausus est.

Membrana, quae canalem cochlearem tecti ad instar operit, membrana Cortiana appellata, superiorem habenulae sulcatae faciem usque ad dentium auditoriorum apices obducit, indeque, ab his discedens (Fig. III, h.), parallelo membranae basilari decursu inito, usque ad cochleae parietem, in quem quidem abit, porrigitur (Fig. II, D—G.). Equidem hunc transitum in cochleae parietem in praeparato quodam, in quo forte lamina spiralis membranacea per totam latitudinem suam in infima cochleae parte discissa erat, membrana Cortiana tamen e nexu suo cum partibus lateralibus non resoluta, plane observare potui. Haec membrana valde tenuis atque hyalina cernitur. Ad accuratiorem ejus descriptionem quod attinet, quum, ne longius a fine proposito abducar, metuam, lectorem benevolum ad ea, quae *Corti* [60]), *Reissner* [61]), *Claudius* [62]) enarrant, relegatum volo.

Supra membranam Cortianam, cui laxius adjacet, epithelium lamellosum admodum tenue atque tenerum conspicitur, quod, e cellulis magnis polygoniis consistens, totam cavitatem cochleae intus vestit. Quod epithelium, a subjecta membrana Cortiana facile dissolutum, praecipue in segmentis transversis plane cognoscitur, in quibus nonnunquam ab habenulae sulcatae dorso solutum libere prominet (Fig. III, g.).

60) l. c. pag. 18.
61) l. c. pag. 425.
62) l. c. pag. 155.

Caput III.

Laminae spiralis nervi.

1. Habenula ganglionaris.

Laminae spiralis nervi, quemadmodum jam supra vidimus, fasciculos nerveos, in modioli canales inclusos, directe continuant. Qui fasciculi hac forma, postquam in laminam spiralem osseam intraverunt, usque in primum ejus trientem decurrunt, inde vero omnes in ganglia mutantur. Hoc modo inter laminae spiralis osseae lamellas series gangliorum, quae alterum juxta alterum collocata inter se coalescunt, efficitur, quae series, veluti taeniola spiralis inde a cochleae basi usque ad ejus apicem porrecta, a *Corti* habenula ganglionaris laminae spiralis cochleae nominata est. Hac gangliorum serie meatus spiralis excavatus, quem supra in lamina spirali ossea contemplanda descripsi, impletus est. Nervorum trunci in hanc gangliorum seriem intrantes, latitudine 0,02‴ — 0,09‴ praediti, ex fibris confertissime positis, 0,0028‴ latis, consistunt, quae lineis extremis duplicibus instructae sunt. Hae fibrae in reliquo suo decursu neque intra modiolum neque in lamina spirali ossea cellulis nerveis instructae sunt. Equidem cochleae nervum statu recenti, modiolo in ichthyocollae solutionem incluso, in segmentis transversis tenuibus perscrutatus nunquam ante habenulam ganglionarem cellulam nerveam deprehendere potui. Ejus modi segmenta tum de fasciculorum nervorum intra modiolum decursu tum de eorum inter laminae spiralis osseae lamellas introitu atque de transitu in habenulam ganglionarem nos certiores faciunt. Qua in re praeterea id commodi percipitur, quod omnes nervorum fasciculi in una eademque modioli dissecti planitie uno conspectu perlustrari queunt, ideoque metuendum non est, ne aliqua pars non pervestigata relinquatur. Multis hujus modi segmentis usus, nunquam cellulam nerveam observare potui, sed ubique fibras aequabiles nec interruptas animadverti.

Qua causa adductus sententiae a *Pappenheim*[63]), a *Stannio*[64]), a *Koelliker*[64]) prolatae nullo modo adstipulari possum. Ceterum vix intelligitur, quidnam sit, de quo virorum doctorum, quos diximus, primus haec verba facit: „Der nervus cochleae ist von oben ganz von einer breiten, röthlich grauen Schicht bedeckt, welche aus nichts als Ganglienkugeln besteht.“

Habenula ganglionaris, cujus latitudo in cochleae basi 0,12‴—0,21‴, crassitudo circiter 0,1‴ aequat, utraque dimensione ad apicem versus paullulum deminuta, non taeniola rectis lineis limitata, sed varicosa est. Unde cognoscitur, eam ex compluribus gangliis, quae alterum juxta alterum posita sint, originem cepisse. Quum hac de re tum de habenulae ganglionaris situ, quem non in exteriore laminae spiralis osseae dimidio, uti *Corti*[65]) affirmat, sed in interiore ejus parte obtinet, nobis persuadere possumus, si, acido muriatico in usum vocato, calcariae sales, qui in cochlea reperiuntur, amoverimus. Qua ratione inita, vel oculo inermi, vel, idque melius, microscopio simplici taeniola ex albido subflava, specie nodosa praedita, quae circa modiolum volvitur atque ab latere suo interiore nervorum fasciculos recipit (Fig. III, a.), ab exteriore dimittit (Fig. II et III, c), in conspectum venit. In segmentis ad perpendiculum factis et taeniolae illius crassitudo et modus ac ratio, qua inter lamellas osseas inclusa est, optime cognoscitur. (Fig. II et III, b).

Habenula ganglionaris majore ex parte cellulis nerveis parvulis consistit, per quarum catervas quum fibrae in diversissimas regiones permeent, massa quaedam compacta, ac perplexa conformatur. Cellulae, plerumque forma ovata instructae, in universum 0,0172‴ longae, 0,012‴ latae, lineâ fuscâ in fibrarum nervearum limites exteriores continue transeunte circumdantur. Massam lentam ac tenacem, subtiliter granulatum, continent, cui nucleus 0,006‴—0,0075‴, nucleolum splendidum in se includens, inest. Cellulae non cinctae

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63) *Papenheim*, die specielle Gewebelehre des Gehörorgans. Breslau, 1840. pag. 62.

64) *Koelliker*, Mikroskopische Anat. pag. 757.

65) l. c. pag. 22.

sunt involucro e tela cellulosa formato, neque ideo, uti in gangliorum spinalium cellulis observamus, tali tela in positione sua retinentur atque a cellulis vicinis nervorumque tubulis separatae sunt, sed, nulla certae formae massa interposita, altera juxta alteram collocatae videntur, sola aquae animalis atmosphaera inter se disparatae.

Statu recenti ut habenulam ganglionarem perquiras, quam difficillime obtingit, quoniam non modo calcariae sales, qui partes obtegunt, observatori sunt impedimento, verum etiam, quum massa admodum intricata atque perplexa sit, praeparatum discerpere maxime arduum est, nec non cellulae habenulam constituentes tam pallidae atque observatu difficiles sunt.

Qua de causa in massa satis pellucida plerumque non deprehenduntur, nisi lineae extremae subrotundae, quae quarum partium sint limites, quoque cum fibris nerveis nexu contineantur, dispicere nequeas. Quin etiam summa opera, quam cellulis sejungendis impenderis, saepe inutiliter insumitur, quoniam, si quando contigerit, ut nonnullas singulas in praeparati margine conspicias, id a solo casu dependet. — Tum vero ea, quam modo descripsimus, cellularum est species.

Fibris quaenam ratio cum cellulis intercedat, etiam difficilius cognoscas. Nam quaevis vel minima vis, quam ad eas disjungendas adhibueris, nexum illarum destruit, ita ut re vera, si conatus tale praeparatum efficiendi centies et pluries successu caruerit, saepe quis adducatur, ut cellulas gangliosas hic exstare prorsus neget. Quod modo dixi, non solum ipse expertus sum, sed *Corti* [66]) quoque affert, talibus verbis usus: „Quant aux cellules nerveuses, dont les appendices se prolongent en deux fibres nerveuses à doubles contours, ce n'est que par hazard, qu'on les trouve, et même très rarement. J'ai étudié quelquefois avec le plus grand soin plusieurs limaçons pendant des journées entières dans le but d'y isoler de telles cellules nerveuses sans en rencontrer une seule."

Alia autem rei ratio est, si habenulam ganglionarem in cochlea per longius temporis spatium in acido muriatico di-

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66) l. c. pag. 52.

luto asservata pervestigaveris. Tum enim, quamquam et tota massa et singulae cellulae fusciores apparent, tamen lineae extremae melius observantur, neque in instituendis investigationibus substantia ossea officit. Talem habenulam ganglionarem si discerpseris (Fig. II, c), saepe in margine singulae cellulae conspiciuntur, quae ab altero fine processum avulsum emittunt, ab altero tali processu cum reliqua gangliorum massa continentur. Tum interdum horum processuum transitus in fibras nerveas, duplicibus lineis extremis praeditas, manifesto cognoscitur. Qui transitus tali modo efficitur, ut processum a cellula nervea emissum fibra nervea complecti videatur. Idem processus, admodum lucidus ac perspicuus, prope ad axis cylindrorum similitudinem accedit, atque, quantum verisimile est, in fibrae axis cylindrum transit.

Ea, quam memoravimus, cellulae cum fibra nervea ratione evenit, ut talis offeratur imago, quasi cellula in fibram simplicibus lineis extremis limitatam transeat, quae brevi, quemadmodum jam saepe observatum est, duplices lineas extremas accipit. Hoc loco cellula tam facile a fibra sua disjungitur, ut dificillimum sit, earum connexum demonstare. Disjunctio, me judice, ita efficitur, ut cellulae processus a vagina nervea ipsos circumdante extrahantur; ad quam quidem sententiam confirmandam afferre possum, alias processus illos in apices acutos exire (Fig. V, b), alias fibras duplicibus lineis extremis praeditas propius ad cellulas accedere, quam processus longitudo esse soleat.

Habenulae ganglionaris acido muriatico diluto tractatae frustum si in partes tenuissimas discerpseris, saepe innumerabiles cellulae in conspectum prodeunt, in quibus comparationes instituere licet. Nonnunquam etiam contingit, ut totam talium cellularum, quae in uno eodemque strato altera juxta alteram positae sunt, catervam contemplari liceat. In universum, quod ad acidi muriatici usum attinet, cellulas, quum corrugentur, forma mutari cernimus. Etenim, minus rotundae apparentes, magis irregulares exsistunt, attamen, id quod observatori summi momenti est, valde manifestae ac perspicuae redduntur. Sunt triangulares, fusiformes, ovatae, subrotundae, magis minusve in longum porrectae, quin etiam

nonnunquam quadrangulae (Fig. V). Earum nuclei pari modo commutantur, utpote qui pro specie aequabiliter rotunda formam magis denticulatam accipiant. Omnino cellularum nuclei magnas diversitates offerunt, ut qui modo cum cellulis eadem, qua solent, ratione teneantur, modo insigni magnitudine excellant, ita ut cellulas fere totas expleant (b). Denique mentio inferenda est imaginis interdum mihi oblatae, qua cellulae nucleus in cellulae processum transire videbatur; neque tamen disquirendum censeo, utrum axis cylindrus e cellulae contento, an ex nucleo originem capiat.

Cellularum processus nunc breviores nunc longiores modo omnino divulsi sunt, modo locum, quo via mechanica avulsi sunt, ostendunt. Cellulae plerumque binos ejusmodi processus habent, neque tamen omnes, uti *Corti*[67]) testatur, bipolares sunt. Contra hanc viri docti sententiam forma etiam, quam cellulae paullulum corrugatae praebent, pugnat, quo accedit, quod ipse cellulas tripolares quam planissime observavi. Etenim in praeparato quodam, in quo forte simplex cellularum deinceps positarum stratum oblatum est, duae earum fusiformes erant, in latere latiore per anastomosin inter se conjunctae (a). Praeterea unaquaeque earum secundum longitudinem suam binos eosque manifestissimos processus emittebat. Cellulas plus quam duobus processibus instructas in periphericis systematis cerebrospinalis gangliis exstare, omnes fere scrutatores consensu negant. Inter quos *R. Wagner*[68]) hac de re talia ait: „Vielstrahlige Zellen sah ich bei keinem Wirbelthiere in peripherischen Ganglien." Unus *Stannius*[69]) cellulas tripolares a sese in piscibus, quamquam raro, inventas delineat.

Qua de causa rationis descriptae mentionem inferendam esse censui, ut appareret, etiam inter gangliorum periphericorum cellulas anastomoses exstare posse, quae hucusque non nisi inter

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67) l. c. pag. 23

68) *R. Wagner*, Neurologische Untersuchungen. Göttingen 1854. pag. 47.

69) *Stannius*. Ueber peripherische Nervensystem der Fische. Rostock 1849. Tab. IV. Fig. 11.

systematis centralis cellulas adesse credebantur. Quodsi neque una neque altera ratio aut in ceteris nervis cerebralibus, gangliis praeditis, aut in gangliis spinalibus pro rata habetur, quoniam neutra ad hunc diem ab ullo observatore inventa est, hinc eorum confirmationem repetendam esse arbitror, quae evolutionis nervi acustici historia nos edocet, qui quidem tantum pro partis cerebri prominentia habendus esse traditur. Exstat in his perfecta cum cellulis nerveis partium centralium congruentia, a quibus nervi acustici cellulae tantummodo magnitudine valde differunt.

Has quoque habenulae ganglionaris cellulas *Corti* [70]) destructu facillimas esse describit, easque aliquot horis post animalium mortem exactis jam non reperiri et aqua perbrevi tempore deleri ait. Qua in re cellulae illae a ratione ista, quae in universum in cellulis gangliorum obtinet, admodum discreparent, namque ipse in felis gangliis spinalibus, quae experiendi causa per quinque dies in aqua, temperie cubiculari praedita, asservavi, quoad haud dubius odor putridus, eorum decompositionem jam factam esse, coargueret, cellulas gangliorum vix commutatas quam certissime cognoscere potui.

Quodsi quis, illi sententiae addictus, qua in trium nervorum sensoriorum supremorum decursu nullae omnino gangliorum cellulae adesse creduntur, et hac re et eo, quod cellulae tripolares reperiantur, innixus cellulas, de quibus diximus, natura nervea esse dubitaverit, equidem haec ei objicienda esse judico.

1. Habenula ganglionaris inter laminae spiralis osseae lamellas ita inclusa est, ut praeter fibras nerveas, confertim positas, quibuscum utrimque conjuncta est, nulli alii elemento ad eam aditus pateat. Eadem magnam cellularum fibrarumque turbam praebet, in quam tantummodo nervorum fasciculi e modiolo proficiscentes abeunt, et ex qua solum fibrae, de quarum natura nervea nulla exstat dubitatio, emittuntur.

2. Quod *Corti* testatur, cellulas quam facillime destrui, mihi omnino negandum videtur. Causa autem, qua fiat, ut eas tam saepe reperire non contingat, sicuti vir

70) l. c. pag 52.

doctus ipse etiam de praeparatis omnino recentibus atque etiamtum calentibus hoc profitetur, in rationibus supra commemoratis quaerenda est. In praeparato ope acidi muriatici tractato, etiamsi id complures per hebdomades vel menses asservaveris, illas semper invenire possis.

3. Ad cellulas tripolares a me observatas quod spectat, in eo, quod nullus scrutatorum ad hoc tempus in aliis animalium vertebratorum superiorum ordinum gangliis periphericis tales cellulas reperit, causa idonea non est posita, cur cellulae nerveae tripolares exstare negentur.

4. Denique non solum ego, sed etiam *Corti* [71]) fibras nerveas, duplicibus lineis extremis praeditas, cum cellulis hisce directo nexu contineri vidimus.

5. Praeter causas modo allatas etiam memorari potest, mihi occasionem datam esse, cellulas in ganglio spinali foetus bovini, 5″ longi, per quattuor menses in kali chromico asservato obvias cum cellulis habenulae ganglionaris comparandi. Quae cellulae tantam inter se similitudinem ostenderunt, ut, si quis duo praeparata permutasset, vix cogniturus fueris, utrum ex habenula ganglionari, utrum e ganglio spinali petitum esset.

2. Nervi cochleae terminatio.

Nervi ex habenula ganglionari egredientes forma fasciculorum tenuium, qui per rete lamina spirali ossea conformatum, multifariam per anastomoses conjuncti, ramulos dimittunt, ad peripheriam versus porriguntur. In cochleae basi fibrae compluribus seriebus altera alteri superimpositae sunt, dum ad cupulam versus strata magis-magisque tenuia constituunt, ita ut ad postremum in lamina modioli singulae fibrae altera juxta alteram positae cernantur. Dum in lamina spirali decurrunt, paullulum ad peripheriam versus radiant, attamen tam parum, ut inter se parallelae haberi queant. Qua in re angulus, quo ad peripheriam tendunt, ad apicem cochleae versus multo acutior exsistit, dum in gyro primo liberum laminae spiralis osseae marginem ad perpendiculum feriunt.

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71) l. c. pag. 52.

Fuscam fibrarum massam (Fig. II. et III. c.), tum in segmentis transversis tum, si eam a superficie intuearis, usque ad angulum, quo duae laminae spiralis membranaceae lamellae inter se coalescunt, persequi licet.

Fibrae omnes, limitibus duplicibus cinctae et eadem, qua fibrae in habenulam ganglionarem intrantes, latitudine praeditae, 0,0028‴ aequant neque, quantum ego observare potui, in ramulos discedunt. Itaque, si *R. Wagner* [72]), pro comperto habet, fibras primitivas in nervo acustico diffindi, res fortasse in ejus trunco, in vestibulo vel in ampullis ita se habeat; in cochlea autem id non animadvertitur.

Praeter fibras nerveas, quas descripsimus, in lamina spirali etiam aliae reperiuntur fibrae, quarum tamen natura atque origo qualis sit, explicatu difficillimum est. Namque non modo ab utroque habenulae ganglionaris latere, verum etiam ulterius ad peripheriam versus, nonnullo intervallo disjuncti, fibrarum fasciculi tenuisssimi decurrunt, qui parallelo gangliorum seriei cursu per omnes cochleae gyros porriguntur (Fig. IV, B). Itaque hi fasciculi cum fibris nerveis supra memoratis (A) re vera decussantur, atque partim iis impositi sunt partim inter eas intertexti cernuntur. Quorum fibrae unde originem duxerint, quo tendant, quae iis cum ceteris elementis nerveis in lamina spirali obviis ratio intercedat, in incerto relinquatur.

Nunc ad fibras nerveas numero praevalentes, de quibus prius mentionem feci, revertamur, quo loco et quanam forma illae terminentur, inquisituri.

Qua de re ut certior fias, non cochleae recentes, quibus *Corti* [73]) usus est, adhibendae sunt; namque, his in usum vocatis, rem non magis, quam vir doctus, penitus disquiras. Lamina spiralis cochleae acido muriatico diluto tractatae, quemadmodum jam supra in habenula sulcata describenda diximus, acu tenui in duas lamellas diffindi potest. Quo modo stratum nervosum aut cum alterutra laminarum connexum, aut, si ab hac sese dissolverit, solum per se atque liberum obtinetur. In ejusmodi praeparatis (Fig. IV.)

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72) l. c pag 10.

73) l. c. pag. 53.

saepe videbis binas fibras limitibus duplicibus circumdatas, alteram proxime alteram sitas, ansam formare, vel, uti aliis utamur verbis, fibram alteram ansae ad instar reflexam ad centrum reverti (b). Ex quovis apice harum ansarum processus lucidus pallidusque, brevis ac forma cylindracea praeditus, prodit, qui, plerumque acuminatus, subito evanescit (c.) Qua in re, si nervorum decursum a superficie laminae spiralis contemplamur, a singulis ansis ejusmodi processus proficisci videtur. In segmentis vero ad perpendiculum factis fusca fibrarum e gangliis prodeuntium massa (Fig. II et III, c.) in fine extremo repente acuminari atque, ut in processum talem transeat (Fig. II, i), velut attenuari cernitur (Fig. II et III, d). Quod quum ita sit, major fibrarum copia cum unoquoque processu juncta videtur. Eundem eventum ita nanciscimur, si magnam fibrarum nervearum atque ansarum, quae in lamina spirali continentur, multitudinem cum processuum numero pro rata parte exiguo conferimus. Quae ansis illis cum processibus his ratio intercedat, nempe utrum processus nonnisi fibrarum neurilema continuent, an revera pro fibris nerveis habendi sint, infra fusius disseram.

Ansarum processus, de quibus exposui, per labii tympanici foramina permeant atque cum interiore fine bacillorum ordinis primi directe cohaerent. — Quod ita se habere, tali modo demonstrari potest:

1. Ansae nervorum in inferiore labii tympanici facie semper usque ad ea foramina decurrunt, in quorum parte superiore organum *Cortianum* initium capit. *)

2. In iis praeparatis, quae stratum nerveum conjunctim cum labio tympanico offerunt, omnes processus ex ansis exeuntes tum numero tum intervallo, quo inter se distant, foraminibus ejus omnino respondere atque in ea abire

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*) Adnotatio. Hoc loco non possum, quin admoneam, imaginem ab *Harless* delineatam (l. c. pag. 447) omnino a vero abhorrere. *Harless* enim nervos tantummodo in summo cochleae fastigio usque ad locum, quo organum Cortianum oritur, decurrere censet, dum in omnibus reliquis laminae spiralis partibus, praesertim in cochleae basi, aliquantum ab eo absint.

cognoscas (Fig. IV, c). Semel praeparatum mihi adfuit, in quo labium tympanicum ab ipsa foraminis parte externa divulsum erat. In hoc casu manifesto apparuit, processum ad foramen pertinentem ex altera parte in illud transire, ex altera rursus in conspectum prodire (d).

3. In segmentis transversis non solum, plenas talium processuum series in bacilla ordinis primi transire, ex congruente directione nobis persuadere possumus, sed etiam, si segmentum feliciter instituerimus, saepe processus singulos per labii tympanici foramina decurrere atque cum interiore horum bacillorum intumescentia conjungi videmus. (Fig. II, i.)

Praeter haec argumenta certa etiam afferendum censeo, *Kölliker* [74]) quoque observationibus suis adductum esse, ut fibras nerveas cum organo Cortiano junctas esse contenderet, etiamsi ejus ex ansis nervorum ortum non animadverterit.

Quum processus tantundem, quantum labii tympanici foramina, inter se distent i. e. 0,004‴, bacilla primi ordinis autem in intumescentia sua interiore, ubi alterum proxime alterum posita sunt atque inter se contingunt, latitudine 0,002‴ aequent, sequitur, ut singulis processibus bina bacilla respondeant. Itaque hoc loco processus diffindi necesse est. Quod quamvis non plane observaverim, tamen mihi praeparata nonnulla adfuerunt, quibus, rem ita se habere, confirmari videretur. Nonnunquam enim processus cum ansa cohaerentis finis ad furcae similitudinem in duas partes diffissus apparet (Fig. IV, e), id quod significare videtur, binas intumescentias ex singulis processibus exoriri. Semel etiam processum in tres partes diffissum vidi (f). Attamen hoc in casu fortasse processus tertius non fuit nisi frustum a pariete intumescentiae bacilli avulsum. Omnino has rationes quam certissime eruere perquam difficile est, ac longiore, quam mihi concessum fuit, temporis spatio ad talia studia opus est, quoad, compluribus praeparatis effectis, feliciter contingat, ut rei lux afferatur.

At, quoquo modo res sese habet, certe hoc constat, bacillorum primi ordinis numerum duplo majo-

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74) *Kölliker:* Ueber die letzten Endigungen etc. pag. 7.

rem esse, quam processuum ex ansis nervorum prodeuntium.

His ita expositis, postquam cognitum est, quid de nervi cochleae fibris fiat, atque postquam singulae laminae spiralis membranaceae partes, quoad ejus fieri potuit, exploratae sunt, jam non difficile est, ea elementa, quae prioris aetatis scrutatores pro nervi cochleae terminis habuerunt, invenire et, sententiae illae num verae fuerint an falsae, dijudicare.

Ex descriptione ab *Hannover* [75]) proposita, ansas perpendiculares alteram juxta alteram positas, quas commemoret, nihil aliud esse nisi dentes auditivos, virumque doctum, veras fibras nerveas pro portione fibrosa, quae in membranam basilarem abeat, putavisse, plane elucet.

Breschet [76]) fibras nerveas ansarum forma finiri contendit, ex quibus profecta involucra neurilematica inde, multimodis inter se decussata, ulterius porrigantur atque, inter se coalescentia, zonam membranaceam constituant. Qui scrutator qua in re erret, opus non est, ut fusius explanem.

Bendz [77]) nervi cochleae fines in laminae spiralis membranaceae superficie vestibulari quaerendos esse existimat, ubi quidem eos ansarum formam prae se ferre arbitratur. Quam opinionem omnino falsam esse, supra vidimus.

Omnes reliqui auctores liberos nervi cochleae fines ibi quaesierunt, ubi ansae a me descriptae exstant, eo tamen intercedente discrimine, quod, dum *Scarpa* [78]), cujus sententiae etiam *Corti* [79]) adstipulatur, eos penicilli specie praeditos esse censet, *Huschke* [80]) et *Krause* [81]) eos ansis similes esse testantur.

R. Wagner [82]), omnes fibras nerveas, quae in labyrintho finiuntur, inter se pares esse ratus, tria finium nervorum genera in hisce partibus statuit, tamen, quod eorum in vestibulo, quod in ampullis, quod in cochlea quaerendum sit, non commemorans.

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75) l. c. pag. 59.
76) *Todd,* Cyclopaed. pag. 541.
77) l. c. pag. 365.
78) l. c. pag. 97.
79) l. c. pag. 25.
80) l. c. pag. 889.
81) l. c. pag. 507.
82) l. c. pag. 143.

Itaque, si, meis ipsius observationibus innixus, sententiae a *Kölliker* prolatae subscribo, qua nervi cochleae fibrae cum organo Cortiano connexu quodam contineri putantur, nunc non tam quaerendum est, ubinam nervi illius fines nondum reperti inveniantur, quam disceptetur oportet, num apparatui illi singulari natura nervea tribuenda sit necne. Quam quaestionem, superest, ut ad liquidum perducere conemur.

Caput IV.

Quaeritur, num organum Cortianum pro apparatu nerveo habendum sit necne?

Cujus sententiae auctor *Kölliker* est [83]), qui, uti ipse confitetur, ob solum connexum, qui inter bacilla fibrasque nerveas intercedit, elementa illa pro unis eisdemque putanda esse judicat. Mihi, quum causa allata neutiquam sufficere videatur, res denuo perquirenda atque examinanda erit.

Jam eam ob causam, quod organum Cortianum ex elementis tam eximie regularibus formaque peculiari praeditis consistit, quae elementa tantummodo cum retinae bacillis comparari possunt, quorum quidem naturam nerveam meliore jure dubitari, quam affirmari, mihi saltem satis constat, parum est verisimile illa elementa indolis nerveae esse, ideoque in cochlea fibras nerveas aliam omnino structuram ac dispositionem, quam in ceteris organismi partibus, ostendere. At accedunt praeterea rationes aliae, quibus id magis etiam vero absimile reddatur.

1. Hucusque talis lex pro rata est habita, ut fibrae nerveae nunquam libere in cavum exeant et solo strato epitheliali a cavo separatae sint. Ubicunque ad hoc tempus fibrae nerveae inventae sunt, in alia tela sc. conjunctiva porriguntur et in hac veluti inclusae cernuntur.

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83) l. c. pag. 7.

2. Nunquam mihi contigit, ut in organi Cortiani bacillis axis cylindros inclusos animadverterem, nunquam etiam, quas *Kölliker* [85]) observavit, varicositates, in quibus filum interius conspici posset. Quin etiam tubulos esse negaverim, eaque potius pro cylindris solidis duxerim. Etenim, si ea, qualia in praeparatis vetustissimis apparent, cum laminae spiralis fibris nerveis comparaveris, dum hae jam dilabi atque friabiles exsistere incipiunt neque amplius vagina medullaris et axis cylindrus internosci possunt, illa ne minimam quidem formae commutationem afferre cernas. Mihi semper tantum bacilla cylindracea visa sunt.

3. Quum admodum sit verisimile, unumquodque bacillum per processum jam commemoratum, quo labium tympanicum perforatur, cum pluribus ansis nervorum cohaerere, haec ratio sane singularis foret, nec cum eis, quae experientia adhuc docuit, in concordiam redigi posset, si quis processum et ejus continuationem nempe bacillum, natura nervea esse crederet.

4. Saepe, praesertim statu recenti, processus ab ansis distractos esse hasque adspectui patere observavimus, quo in casu speciem omnino rotundam praebent. Processus si fibras nerveas earumque contentum directe continuarent, ansas semper destrui, atque interdum axis cylindrum e fibris egredientem conspici necesse foret.

5. Intumescentia, quae est in interiore bacillorum primi ordinis fine, si organum Cortianum e fibris nerveis constaret, non posset, quin pro globulo ganglioso bipolari putataretur, id quod etiam *Kölliker* censet. Attamen mirationem movet, quod haec intumescentia, etiamsi diutius in acido muriatico fuerit, formam suam omnino non mutat, dum habenulae ganglionaris cellulae corrugantur. Pariter ejus nucleus semper circulus aequabilis manet, dum illorum gangliorum nucleus ClH usu peripheriam magis minusve denticulatam accipit. Equidem, quum nucleum illum tantummodo si bacilla desuper inspicerem, non item in segmentis transversis observare potuerim, eum exstare omnino dubitaverim, potiusque pro pellucente processus intrantis facie circulari

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84) l. c. pag. 7 et 8.

habendum esse crediderim. Tota intumescentia nescio an eum in finem adsit, ut bacillis supra foramina sitis, ne per haec deorsum delabantur, adminiculum offerat.

6. Quod ad formam bacillorum spectat, ubi, quaeso, fibrae nerveae conspiciuntur regulari figura ad S litterae similitudinem incurvata praeditae? ubi fibrae nerveae nunc tenuiores nunc crassioros exsistere cernuntur? ubi denique fibras nerveas, forma cylindracea exuta, in intumescentias quadrilateras mutari cognitum est?

7. Bacilla ordinis secundi bacillis ordinis primi non ita, ut altera alteris respondeant, opposita esse, supra demonstravi. Qua in re, ut bacilla nervi stimulos propagent, fieri non potest. Ceterum, licet ponamus, duorum ordinum bacilla pari numero atque, uti *Corti* et *Kölliker* judicant, singula externa cum singulis internis in contactu esse, tamen ne sic quidem stimuli nervis propagari possent, quoniam nullo organismi loco nervorum irritamenta per duas fibras nerveas inter se contiguas propagantur.

8. Denique res gravissimi momenti accedit, i. e. quod bacilla ordinis secundi in membranam basilarem transeunt. Cur hac partes inter se coalescere credendae sint, supra exposuimus. Attamen tali cum membrana connexu fibras nerveas contineri non posse, experientia hucusque docuit. Quae ratio quamvis ad sola ordinis secundi bacilla pertineat, tamen haec bacillis primi ordinis adeo sunt congrua, ut utrorumque telam unam eandemque esse dubitari nequeat. Est potius verisimillimum, omnia bacilla eadem, qua membranam basilarem, tela consistere, id quod jam inde conjici potest, quod cum hac membrana coalescunt. Hoc et *Corti*[85]) censet, his verbis prolatis: „La composition chimique de ces dents parait être égale à celle de la lame spirale membraneuse."

Quibus rationibus adductus facere non possum, quin, cum *Kölliker* dissentiens, organum Cortianum cum processibus, qui ex ansis nervorum proficiscuntur, apparatum nervosum esse negem, ulti-

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85) l. c. pag. 47.

mosque nervi cochleae fines forma ansarum instructos inter duas, ex quibus lamina spiralis membranacea exsistat, lamellas repositos esse statuam.

Deinde placitum a ***R. Wagner***[86]) prolatum, quo primitivas fibras nerveas nunquam fines ansis similes habere, et ad omnes fibrillas nerveas hanc legem pertinere censet, ut in liberos fines exeant, non in omnibus partibus verum ratumque esse arbitror.

Ad meam de organo Cortiano sententiam quod attinet, id accessorium quemdam nervi cochleae apparatum esse judico, qui ad sensum audiendi provocandum quam proxime pertineat. Hoc organum igitur de nervo cochleae similes partes agere existimo, atque quas corpuscula ***Pacini*** et corpuscula tactus, vel bacilla retinae in nervos ad ipsa pertinentes sustineant; attamen, quum leges acusticae, quae de cochlea valent, adhuc in obscuro sint positae, quavis de functione ejus physiologica hypothesi abstinendum censeo.

Gravissimae atque, quantum confido, satis certae conclusiones, quas ex disquisitionibus meis deducere licet, hae sunt:

1. Membrana Cortiana, uti ***Claudius*** statuit, ab dentibus auditivis parallelo laminae spirali membranaceae decursu usque ad internam exterioris cochleae parietis faciem porrigitur, ita ut cum lamina spirali membranacea canalem occlusum efformet.

2. Aperturae labium tympanicum perforantes incisuris, inter dentes auditivos interpositis, vel his dentibus ipsis numero respondent.

3. Per has aperturas ansarum nervi cochleae processus penetrant, qui continue in ordinis primi bacilla transeunt.

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86) l. c. pag. 146.

4. Quum lata horum bacillorum initia seriem continuam, non interruptam, constituant, atque latitudine dimidiam tantum partem intervalli aequent, quanto binae aperturae inter se distant, unumquemque processum in bina talia bacilla diffindi necesse est.

5. Ordinis primi secundique bacilla non pari sunt numero, sed terna binis respondent.

6. Ordinis secundi bacilla fine suo extremo cum membrana basilari perfecte coalescunt.

7. Utriusque ordinis bacilla, forma S. litterae similia, finibus quadrangulis inter se contingunt, qui propter ipsam illam totorum bacillorum speciem non plani membranae basilari impositi sunt, sed supra ejus altitudinem adscendunt libereque in canalem cochlearem prominent.

Explicatio tabulae.

Fig. I. Segmentum laminae spiralis membranaceae, qualis, inde a scala vestibuli considerata, tum membrana Cortiana tum majore cellularum canalem cochlearem explentium parte amotis, observanti offertur. Praeparatum, e secundo cochleae gyro petitum, trecenties vicies amplificatum est.

A — B. Periosteum lamellam superiorem laminae spiralis osseae obducens.

B — E. Superior lamellarum, ex quibus lamina spiralis membranacea oritur (zona cartilaginea).

C — E. Labium tympanicum.

C′— D. Dentes auditivi.

E. Locus, quo lamellae superior inferiorque, ex quibus lamina spiralis membranacea exoritur, inter se coalescunt.

E — F. Membrana basilaris.

E — G. Membranae basilaris pars non plicata.

G — F. Membranae basilaris pars plicata (Lithographus has plicas prorsus neglexit).

F. Locus, quo membrana basilaris in ligamentum spirale transit.

a. Vasa periostei.

b. Massae fundamentalis hyalinae eminentiae.

c. Cellularum in massam fundamentalem inspersarum series, quales in zonae cartilagineae superficie conspiciuntur.

d — d′. Stria lucida luce reflexa e sulco spirali orta.

e. Cellularum series inter dentes auditivos continuata.

f. Sulcus spiralis infra dentes auditivos decurrens, hoc loco, aliquot dentibus remotis, denudatus.

g. Sulcus e semicanale spirali in labium tympanicum pergens.

h. Foramen labium tympanicum perforans.

i. Ortus bacillorum ordinis primi supra labii tympanici foramina.

k. Intumescentia in externo bacillorum primi ordinis fine obvia.

l. Intumescentia in interno bacillorum ordinis secundi fine obvia.

m. Finis bacillorum ordinis secundi externus cum membrana basilari coalescens.

o. Vas spirale.

p et *p'*. Epithelium lamellosum totam membranam basilarem obducens et in sulcum spiralem infra dentes auditivos transiens.

Fig. II. Tenuissimum segmentum transversum laminae spiralis. Praeparatum, e secundo cochleae gyro desumptum, trecenties vicies amplificatum est.

A—B. Lamellae superioris laminae spiralis osseae pars interior.

B—C. Lamellarum, ex quibus lamina spiralis membranacea oritur, superior.

A'—B'. Inferior laminae spiralis osseae lamella.

B'—E. Lamellarum, ex quibus lamina spiralis membranacea oritur, inferior.

D. Crista spiralis acustica s. labium vestibulare.

Litterae *C—E, E, E—F, F, k, l, m, o* eadem, quae in Fig. I, designant.

C. Sulcus spiralis.

D C E F G. Canalis cochlearis.

a. Vasa laminae spiralis.

b. Habenula ganglionaris in parte media discissa.

c. Fasciculi nervorum ex habenula ganglionari progredientes et ad peripheriam decurrentes.

d. Locus, quo fibrae nerveae in ansas transeunt.

i. Processus ex ansis nerveis ortus, qui per labii tympanici foramen in canalem cochlearem intrat atque in interiorem bacilli ordinis primi finem transit.

h. Intumescentia in interno bacillorum ordinis primi fine obvia.

Fig. III. Crassius segmentum laminae spiralis gyri primi, trecenties amplificatum.

Litteris *A—B, B—E, A'—B', B'—E, E, b, c, d,* eaedem denotantur partes, quae in Fig. II.

D. Dentes auditivi.

a. Fasciculi nervorum in habenulam ganglionarem intrantes.

e. Foramen labium tympanicum perforans.

f. Dens auditivus, supra dentes vicinos elatus.

g. Pars strati epithelialis, quod cavum cochleae intus vestit statuque normali membranae Cortianae superimpositum est.
h. Membrana Cortiana.
i. Membrana basilaris.

Fig. IV. Haec figura laminae spiralis stratum nervosum inde a parte tympanali, lamella inferiore amota, ostendit.
A. Fines extremi fibrarum nervearum ex habenula ganglionari exeuntium.
B. Fibrarum nervearum fasciculi parallelum habenulae ganglionari decursum ineuntes et eum fibris prioribus decussati.
C. Labii tympanici pars, quae cum strato nervoso conjuncta mansit.
a. Foramen labium tympanicum perforans.
b. Ansa nervea.
c. Ansae nerveae processus in labii tympanici foramen abiens.
d. Ansae nerveae processus in parte vestibulari rursus in conspectum veniens.
e. et *f.* Duarum ansarum nervearum processus furcarum ad instar diffissi.

Fig. V. Cellularum habenulae ganglionaris caterva.
a. Anastomosis inter duas cellulas nerveas.
b. Cellula nervea, nucleo permagno instructa.
c. Cellula nervea, cujus nucleus in fibrae nerveae axis cylindrum transire videtur.

Theses.

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1. Ad efficiendum audiendi sensum cochlea gravissima labyrinthi pars est.

2. Sententiam cl. *E. H. Weber*, „sonos per ossa capitis ad auditum propagatos cochleae potissimum ope audiri", falsam esse censeo.

3. Ventriculus nomine glandulae designandus est.

4. Largior cerevisiae usus in his nostris regionibus magis magisque percrebrescens propriam morbi formam provocabit.

5. Politiae medicae est, neonatorum praeputii circumcisionem inter limites quosdam continere.

6. Musculorum inspiratoriorum contractione durante, exspiratio fieri potest.

7. Durante inspiratione, thoracis pars in tota peripheria coarctari potest.

Fig. I.

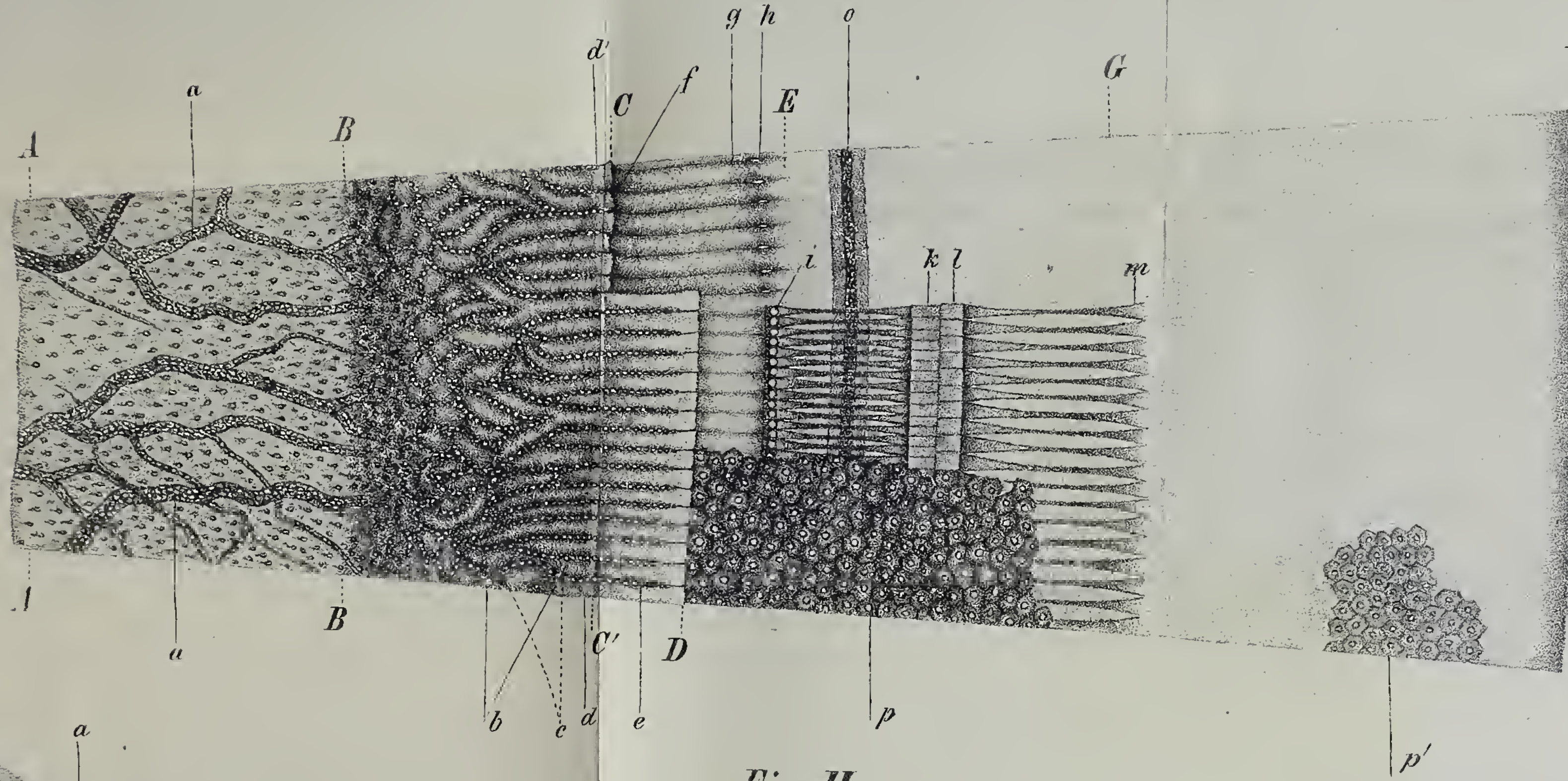


Fig. II.

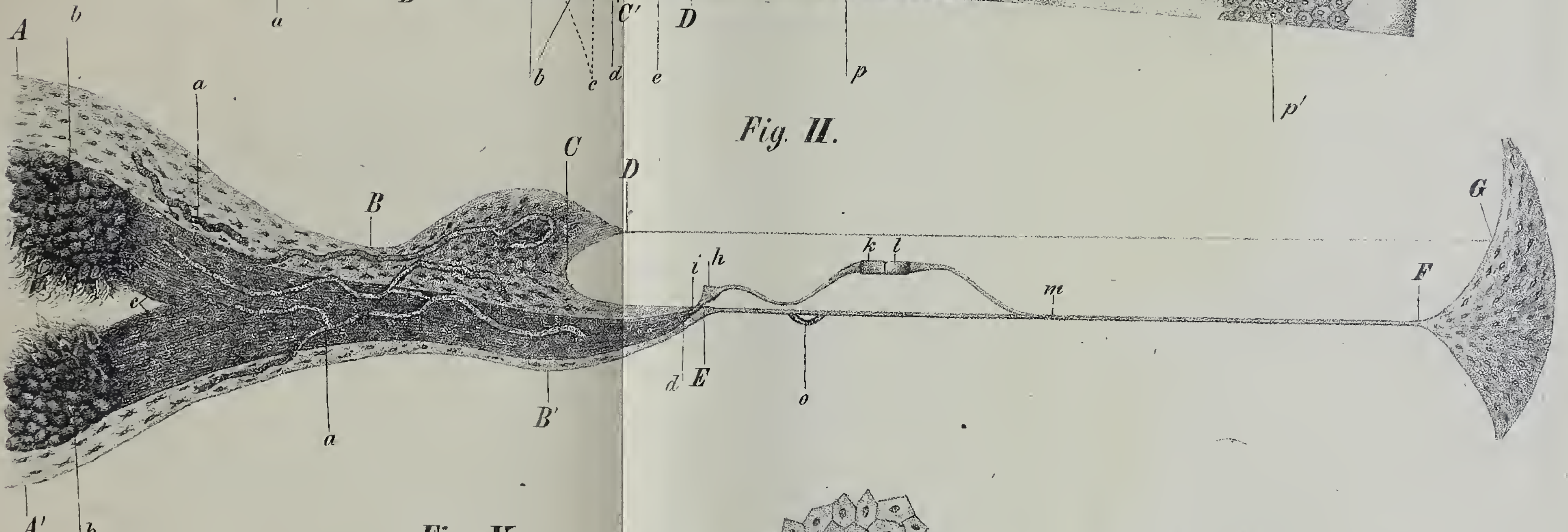


Fig. V.

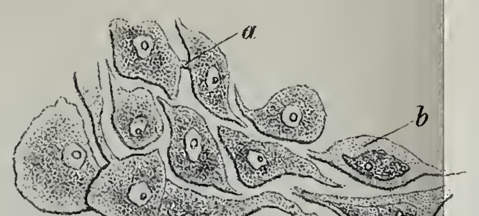


Fig. III.

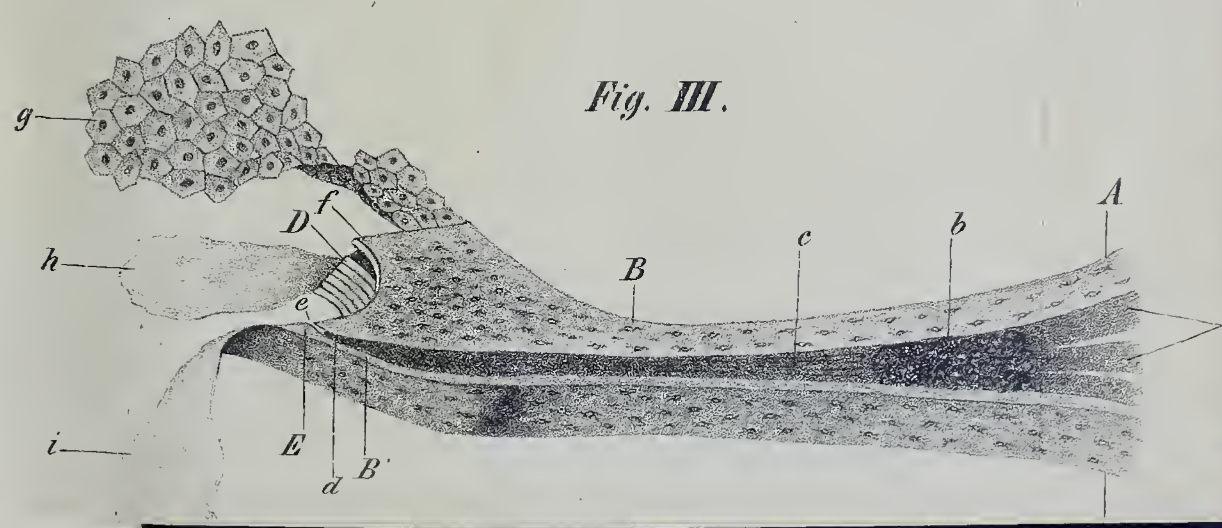
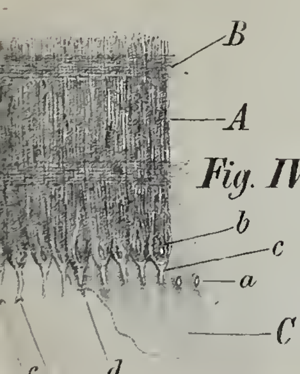


Fig. IV.



DESCRIPTION

OF A

DEFORMED, FRAGMENTARY HUMAN SKULL,

FOUND IN

AN ANCIENT QUARRY-CAVE AT JERUSALEM;

WITH

AN ATTEMPT TO DETERMINE, BY ITS CONFIGURATION ALONE, THE ETHNICAL TYPE TO WHICH IT BELONGS.

BY

J. AITKEN MEIGS, M. D.

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"Skulls, madam," said the Sexton.—"Some of them must have belonged to strange fellows. Only see that one! Spirit of Eld, what a skull."—Lavengro.

PHILADELPHIA:
MERRIHEW & THOMPSON, PRINTERS,
1859.

DESCRIPTION

OF A

DEFORMED, FRAGMENTARY HUMAN SKULL

FOUND IN

AN ANCIENT QUARRY-CAVE AT JERUSALEM.

In September, 1857, Mr. J. Judson Barclay kindly presented to the Academy a fragmentary human cranium discovered by him in an immense quarry-cave at Jerusalem.

The location in which this skull was found, the circumstances attending its discovery, and the very peculiar form which it exhibits, in consequence of the perpendicular flatness of the occiput, render it highly interesting to the craniographer.

From a communication* which appeared in the *Ladies' Christian Annual* for May, 1855, and a letter dated Philadelphia, Aug. 21st, 1857, addressed to the writer by Mr. Barclay,† I gather the following interesting particulars concerning the finding of this skull.

Having received some information of the existence of a very extensive cave near the Damascus gate of Jerusalem, (entirely unknown to Franks,) Mr. Barclay, in conjunction with his father and brother, resolved upon its exploration. Accordingly, having obtained permission to this effect, from the Nazir Effendi, they repaired to the cave, the mouth of which is situated directly below the city wall, and the houses on Bezetha. They found the wall at this spot about ten feet in thickness. Through a narrow, serpentine passage which traverses it they gained an entrance into the cave. The length of the cavern they estimated

* Entitled, "Extract from a Journal kept by R. G. B., during a three years' residence in Jerusalem." See also "The City of the Great King; or, Jerusalem as it was, as it is, and as it is to be." By J. T. Barclay, M. D. Philada. 1858, p. 458.

† See Proceed. Acad. Nat. Sci. for Sept. 1857, p. 177.

at seven hundred and fifty feet, and the circumference upwards of three thousand feet. The roof is supported by numerous regular pillars hewn out of the solid limestone rock. The floor from the entrance to the termination forms an inclined plane, the descent of which is in some places very rapid. About 100 feet from the entrance a very deep and precipitous pit was discovered containing a human skeleton; supposed to be that of some unfortunate who had fallen headlong down and broken his neck, or rather his skull, judging from the fracture which it exhibits. The bones, of almost giant proportions, gave evidence, from their decayed state, of having remained in that position for many years. The skull, unlike the rest of the skeleton, was in a remarkable state of preservation. Numerous crosses on the wall indicate that the devout Pilgrim or Crusader had been there; and a few Arabic and Hebrew inscriptions—too much effaced to be deciphered—prove that the place was not unknown to the Jew and the Arab. The explorers found many intricate, meandering passages leading to immense halls as white as the driven snow, and supported by colossal pillars of irregular shape; some of them placed there by the hand of nature, others of them evidently by the stone quarriers to prevent the intumbling of the city. From their explorations the party concluded that this cavern and the Grotto of Jeremiah, two or three hundred yards distant, originally constituted one immense cave which was formerly the great quarry of Jerusalem.

The cave appears, therefore, to be a very old one. An allusion to it under the name of the "Cotton Grotto" is made by Kadi Mejr-ed-din in an Arabic MS., entitled "The Sublime Companion to the History of Jerusalem and Hebron," and bearing date, A. D. 1495. A gentleman who entered the cave subsequently to the visit of the Messrs. Barclay, tells us, in the "Boston Traveller," that though its existence was long suspected, "nothing was positively known regarding it, as it has been kept carefully closed by the successive governors of Jerusalem. The mouth of the cavern was probably walled up as early as the times of the crusades, to prevent its falling into the hands of a besieging army; earth was thrown up against this wall, so as effectually to conceal it from view, and it is only upon the closest scrutiny that the present entrance can be perceived." Piles of stone chippings, and blocks of stone but half-quarried, and still attached by one side to the rock, were encountered in different parts of the cave. The marks of the cutting instruments were as plain and well-defined as if the workman had but just ceased from his labor. Those who visited the cave were of the opinion that it had been worked as a quarry during the days of Solomon. The following reasons appear to favor this opinion. The stone is the same as that of the portions of the Temple wall still remaining, and referred by Dr. Robinson to the period of the first building. From the former entrance of the cave to the Temple area is a gently inclined plane—a fact that suggests a satisfactory solution of what has heretofore been regarded as a very puzzling question—the difficulty of placing in their present situation, such immense masses of rock as those found at the south-east and south-west corners of the Temple wall. The heaps of chippings which lie about show that the stone was dressed *on the spot*, which accords with the account of the building of the Temple. To these reasons we may also add the extent of the quarry, the amount of stone which must have been worked out there, the size of some of the blocks themselves, the extreme age of the part which has been exposed to the action of the elements, and which dates back in legends and traditions to the time of Jeremiah, the fact that there are no other quarries of any great size near the city, and especially the fact that in the reign of Solomon this quarry, in its whole extent, was *without the limits of the city.*

In the absence of any positive evidence to be derived from the skull itself, these statements are introduced here as being calculated to throw some light upon the question of its antiquity or modernness, and consequently, to a certain extent, its nationality.

The cranium found in this cave (No. 1031 of the collection) is probably that of a man aged about 40 or 45 years. In structure it is moderately dense and heavy, and from its general appearance would scarcely be regarded as an ancient skull. It is, unfortunately, in a very fragmentary condition, consisting of the two ossa parietalia, the left temporal, nearly all that part of the os occipitis posterior to the foramen magnum, and enough of the frontal bone to determine the calvarial form. The facial, right temporal and basal bones are altogether wanting. It has evidently been a short, broad and high skull. The coronal region is triangular in shape, with the truncated apex of the triangle directed anteriorly and coinciding with the frontal diameter. The skull belongs therefore to the Triangular Type of the Class Brachyplatupsidæ—the 25th in the new and comprehensive classification of human crania, which I propose to bring before the Academy at some future time. The bi-frontal diameter measures about 4 inches; the bi-parietal, between the ossific centres, 6½ inches; the vertical diameter, from the posterior edge of the foramen magnum to the highest point of the crown directly above, 6⅝ inches; the intermeatous diameter about 2½ inches. The antero-posterior or longitudinal diameter of the head must have measured about 6½ or 6¾ inches. The occipital bone rises vertically from the posterior margin of the great foramen to meet the parietalia which bend abruptly downward between their lateral protuberances. This striking peculiarity gives to the posterior part of the head the same broad, high, and perpendicularly flattened appearance, so characteristic of Peruvian Crania. The superior transverse ridge of the occipital bone is well-defined; and the occipital protuberance sharp and prominent. The mastoid process of the temporal bone is large and massive.

Upon the inner surface of the left side, and directly opposite the parietal centre of ossification, there is a solution of continuity in the vitreous table. Both the vitreous and diploic structures at this spot have decayed away or been absorbed, leaving a cavity of an irregularly oval shape, and about five-eighths of an inch long, and half an inch wide. Judging from several minute fissures which radiate in different directions from the edges of this cavity, the latter is the result of a blow, which, without affecting the outer or fibrous, has been strong enough to fracture the inner table. A portion of the surrounding surface of the skull, extending about one inch from the margin of the cavity, is stained of a reddish or iron-rust color.

The muscles attached to the sharp external occipital protuberance, to the well pronounced superior and inferior semi-circular lines or ridges of the os occipitis, and the intervening rough surface, must have been well developed; so that the nape of the neck formed, in all probability, a plane continuous with the back of the head. When with this peculiarity we couple the fact that, owing to the relative position of the external auditory meati, the ears must have appeared to be attached rather to the back part than to the sides of the head, we can readily imagine that the individual to whom the skull belonged must have presented quite a bizarre appearance. The glenoid fossa of the left side remains intact and is especially worthy of notice, since it happens to constitute in this skull the only connecting link or point of attachment between the calvaria and the missing bones of the face. If the Cuvierian law of the correlation or harmonization of forms could be practically applied to the separate pieces composing the human cranium, this fossa would assume a still greater importance, since by means of it the outline of the bony face could be determined, and the observer having, in this indirect way, obtained an exact idea of the shape of the entire head, could proceed more confidently to indicate the precise ethnic type of which this skull is a specimen.

Impracticable, however, as this is, we can approximate the desired information by observing attentively the exact appearance of this fossa. The zygomatic tubercle is well marked; the eminentia articularis, instead of being flatly rounded, as is ordinarily the case, is sharp and well defined, while the anterior

wall of the glenoid cavity is thick and unusually convex. Instead of shelving backwards and upwards from the articular eminence, as is usually the case, particularly, as I am inclined to think, in long heads, it rises abruptly and almost perpendicularly, giving the fossa somewhat the appearance presented by this cavity in the carnivora, and indicating powerful up and down movements of the lower jaw, with diminished lateral action. The lateral motion of the jaw must have been still more restrained by the backward inclination of the internal end of the inferior root of the zygoma. The condyle adapted to such a fossa must have been large and heavy, with a correspondingly short and thick neck. Such characters indicate a heavy, square jaw, with short rami and a flattened or retracted symphysis menti. Corresponding with this, as the head is brachykephalic, the superior maxilla must have been heavy and flat and the malar bones prominent. Reasoning thus we may infer from the glenoid cavity that the face of this skull partook of the Tschudic, or even approximated the Mongolian form.

It is, perhaps, impossible to say positively whether this skull is a very old or quite a modern one. A knowledge of the precise epoch to which it should be referred, would assist somewhat in the determination of its nationality. I have already said that from its appearance it can scarcely be regarded as an ancient skull. Yet the appearance and degree of density of bones are by no means reliable criteria of their age; for it is well known that bones of the same age exhibit great dissimilarity in these respects, according to the location in which they have been deposited, according as they have been buried in the ground, deposited in caverns, submerged in water, or freely exposed upon the surface of the earth to air and light. The quantity and quality of the mineral and saline matters contained in the water in which such bones may have been placed, the nature of the soil in which they may have been inhumed, and other circumstances, are known to exert, in the course of time, peculiar changes in both the animal and earthy matter. But the data by which to determine with certainty the time required to produce such changes are wanting. Equally recent bones deposited in the same cave at the same time often exhibit very different appearances after the lapse of many years. And yet the circumstances of location, and the absence or presence of animal matter, are the only, and, it must be confessed, very unreliable criteria by which to determine the age of bony remains. A piece of the Jerusalem skull pressed against the tongue adheres slightly. A small fragment was pulverized, treated with ether, washed and thoroughly dried by exposure to a gentle heat. One drachm of the bone thus treated was macerated in a mixture consisting of three parts water and two parts hydrochloric acid. In eleven hours it was thoroughly dissolved, the solution being accompanied at first with a moderately active liberation of carbonic acid gas. A few pellicles of a gelatinous matter that had collected upon the surface of the liquid were removed and carefully dried. They weighed 11 grains. Sulphuric acid was then added to the liquid drop by drop until there was no longer any precipitation of lime. The supernatant liquid was poured off, and the sulphate of lime effectually dried by exposure to the sun and afterwards to the heat of an oven. It weighed 48 grains. One grain of the original weight was thus lost in the process. From this rough analysis it will be seen that the bones composing the skull under consideration contain a less percentage of animal and a greater percentage of calcareous matter than is contained in decidedly recent bones. A piece of an ancient Burgundian skull, reported to be about 2000 years old, a fragment of the skull of an ancient Roman, found in a tomb on the road between Cumæ and the ruins of Baiæ, and a fragment of the skull of a young aboriginal female taken from an ancient tomb at Ticul in Yucatan, were subjected to the same analytical process. They were found to consist almost wholly of earthy matter. The animal matter had almost entirely disappeared. These bones were dissolved in a much less time than the piece from the Jerusalem skull, and their solution gave rise to a very active formation and escape of gas.

Great interest attaches to this skull on account of the fact that it presents an excellent opportunity to test the differential value of certain craniographic characters,—those pertaining to the crown, occiput and temporal region. The true value of craniographic criteria has not yet been settled. The special investigations in this branch of natural science are as yet too limited, and many of them have been undertaken in so hasty and unphilosophical a spirit, and with such imperfect views of the method that rules in craniography, that the generalizations thus far effected are not only few in number and of limited application, but must be used in the most careful and discriminating manner. It is well known to the members of the Academy that a skull in the collection marked Phœnician* was sent by M. Fresnel, the celebrated archæologist, to the late Dr. Morton, without the slightest information as to where, or the circumstances under which, it was found. After a careful study of its race characters, Dr. M. pronounced it to be a Phœnician. He afterwards learned from Fresnel that it was found in the sepulchral cave of Ben-Djemma, in the Island of Malta, and probably belonged to an individual of that race, which, in the most remote times, had occupied the northern coast of Africa and the adjacent isles.† It will thus appear that Dr. M., guided by osteologic characters alone, was enabled to announce the correct geographical locality of this skull, and perhaps also its true ethnic value; though of this latter point I entertain, at present, some doubts, arising from the remarkable resemblance which this skull bears to that of a wandering Chingân of Transylvania, depicted in Blumenbach's Decades (Tab. xi.) In like manner, some time before his death, Dr. Prichard sent to Prof. Retzius two human crania, requesting an opinion as to the race to which they belonged. He pronounced one of them to be Roman and the other Celtic, and was informed by Prichard that he was in all probability correct, for the two skulls had been dug up in an old battle-field at York, England, where the ancient British Celts, the Belgæ Brittanorum, had been vanquished by the Romans.‡ Another instance, similar to these, will presently be referred to. With such examples before me, I have been led to attempt, as far as the materials at my command would allow, to identify ethnically the skull from Jerusalem. It will be borne in mind that Drs. Prichard, Morton and Retzius had entire skulls submitted to them. The skull from Jerusalem, on the contrary, is, as we have just seen, in a very fragmentary state. It may be said that the knowledge of the locality in which this skull was found would assist materially in this investigation. But that this is not the case will at once be seen when we call to mind that this locality has been, for centuries, a great rendezvous for many races of men, coming from various parts of Europe, Asia and Africa. Moreover the skull is unique, not only in its form, (of which there is not an exact counterpart in the whole Mortonian collection,) but also in the fact that none others were found with it. Desirous of ascertaining whether any other skulls, similar in form to the one under consideration, had been discovered in Palestine, I examined a number of works of travel. At length, in the second volume of such a work published at Dublin in 1840, and entitled "Narrative of a voyage to Madeira, Teneriffe, and along the shores of the Mediterranean, by W. R. Wilde, M. R. I. A., &c.," I found a curious account of the discovery of some human skulls in one of the ancient tombs near Jerusalem.§

During his sojourn in Jerusalem Dr. Wilde learned that within the ground denominated Aceldama, or Field of Blood, (situated to the south of Mt. Sion,

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*See Catalogue of Human Crania, p. 28.

†See Patterson's Memoir of Morton in Types of Mankind, p. xl.

‡Blick auf den gegenwärtigen Standpunkt der Ethnologie in Bezug auf die Gestalt des Knöchernen Schädelgerustes. Von Prof. A. Retzius, Berlin, 1857, p. 6.

§A short notice of these crania is also contained in the Edinburgh Phrenological Journal, vol. 14, p. 217.

in the Valley of Hinnom, and close to the Mount of Offence,) and in the neighborhood of the painted chambers and the excavation called the tomb of Isaiah, some Arabs had accidentally discovered the doorway of a tomb carved out of the solid rock and concealed by a heap of rubbish, over which the soil had accumulated so as completely to hide the entrance. The doorway represented a Doric pediment, supported by rude pilasters, with some remains of floral embellishments, characteristic of Hebrew sculpture, carved upon the architrave. The interior of the tomb consisted of an oblong hall, cut with great precision out of the rock, and having at the inner end and on each side, a number of doors leading into small, oblong chambers or crypts, about seven feet long. On each side of these crypts was a trough or sarcophagus, hewn out of the solid rock, and filled with confused heaps of human bones in an astonishing state of preservation. Each set of crypts contained the skulls of distinct races of mankind. Dr. Wilde secured four of these crania, carried them to Europe, and through Dr. Graves of Dublin, sent casts of them to Dr. Prichard for examination. All the crypts on the right hand side of the tomb contained dense, heavy crania of a long, narrow form, with a flat, recedent forehead, very well marked superciliary ridges, and a prognathous superior maxilla. They evidently belonged to the African type. The skulls in the left hand crypts were of a shape the very reverse, as shown in plate 2, fig. 4 of Dr. Wilde's lithographic illustrations. "Although this skull," says the Dr., "differs in some respects from the true Mongolian, yet under that variety it must be classed. Its most striking character is its very remarkable narrowness in its longitudinal diameter, not only in contradistinction to the Ethiopian, which is characterised by extensive length, but in comparison with all other known crania. *It has an uncommon breadth and flatness of the occipital or posterior region;* and the very remarkable protuberance at the top of the head gives this skull a place among those termed pyramidal." Dr. Prichard regarded this skull as of Turkish origin, approaching the true Mongolian type more closely than any other. Dr. Wilde considers it probable that the skull appertained to some of the Turcoman tribes which still wander in hordes over the countries anciently named Parthia, Mesopotamia, Cappadocia and Pamphylia.

From the above description it will be seen that this skull resembles the fragmentary cranium from Jerusalem. The two appear to belong to closely related types or forms, as may be demonstrated by comparing the fragment under consideration with the drawing given by Dr. Wilde. The form shown in the latter is not the true Turkish as Dr. Prichard supposed. Had he compared Dr. Wilde's specimen, as I have Mr. Barclay's, with the skull of a Turk figured by Blumenbach, (Table 2,) he would have seen that though alike in the shortness of the longitudinal diameter, they are too dissimilar in the configuration of the occiput to be regarded as specimens of the same cranial type. It must be borne in mind, however, that Dr. Prichard frequently used the term "Turkish" as synonymous with Mongolian. Into this too comprehensive use of the term he appears to have been betrayed, in consequence of having adopted the questionable opinion of Remusat, Klaproth and Ritter, that the Turks are not a distinct people, *ab origine*, but descendants of the Hiong-Nu, who, anterior to the Christian era, threatened to overrun and subjugate China with their mighty hordes.* Domalius D'Halloy† and Latham‡ assign to the Turks a Scythic origin. The latter expressly says that he considers the Mongoliform physiognomy to be the rule with the Turk and not the exception, and that the Turk of Turkey exhibits the exceptional character of his family. I can find no good reason for thus confounding the Mongolians proper with the

* Nat. Hist. of Man, p. 290.
† Des Races Humaines, Paris, 1845, p. 81.
‡ Varieties of Man, pp. 78–9.

Turks. Judging from the figure in Blumenbach's Decades, above alluded to, the Turks are craniographically distinct from the Tartars and the Kalmucks, and should be regarded, as I have elsewhere maintained,* as an originally peculiar race, standing mid-way between the European and the Mongol, with which they are transitionally connected by sub-types, which have resulted from a double amalgamation on the part of the Turk, whose genealogical impurity we know to be very great. In the absence of Turkish crania in the collection, I am not able to speak positively upon this subject. In the Museum of the Army Medical Department, Fort Pitt, Chatham, England, there are two skulls obtained from the Turkish burial ground at Scutari. These are described by Dr. Williamson, in the following words: "No. 18. Cranium large, round, and very capacious; forehead high; vertex high, and very well arched; occiput rounded; space for the downward development of the cerebellum considerable; nasal bones well arched. No. 19. Cranium very large and capacious, and exceedingly well arched; forehead high and broad; vertex high, and occiput well rounded; facial bones well placed; the alveolar processes perpendicular, and the facial angle very high; lachrymal canal large."† The Turkish cranium is nearly globular, and though the external, occipital protuberance is but little developed, yet the occiput as a whole is rounded, and not vertically flattened as in Dr. Wilde's specimen, and the fragment found by Mr. Barclay. The latter is therefore not Turkish. Neither is it Jewish, for the Semitic skull, judging from the specimens in the collection of the Academy, is a long oval in form. Thus No. 842, the skull of a Theban Hebrew, ætat. 40 years,‡ belongs to the dolicho-kephalic class of Retzius. The crown is oval in shape, and the occiput regularly rounded. Nos. 818, 845, 865 and 870 exhibit the same general form, as may be seen by referring to the lithographic representations of these skulls in the Crania Ægyptiaca of Morton.§ No. 807‖ is an oblong and somewhat angular head, with a perceptible flatness of the basal portion of the occiput, which renders the occipital protuberance apparently more prominent than in the other skulls of this group. No. 879,¶ though preserving the oval configuration, is not so long a head as the others. In the 28th and 34th Tables of the Decades Craniorum, Blumenbach figures two Jewish skulls,—one of a young person and the other of a centenarian. Unfortunately they are represented neither in profile nor in posterior view, and it is impossible, therefore, to determine satisfactorily the shape of the occipital region, or even the general form of the skull. In describing the physical characters of the Semitic Atlantidæ, (Arabians, Jews and Kaldani or Syrians of Kurdistan,) Latham says that these people possess "dolikhokephalic capacious crania, with straight or prominent nasal and orthognathic maxillary profiles."** In another place he says that the cranium of the Jew differs from that of the Arab in its greater capacity.†† Dr. Williamson describes a "Skull from the Jews' burial ground, on the road to Kollalie," in the following terms: "Forehead low and and receding; posterior part of the cranium large compared to the anterior; superciliary ridge high and

*Cranial Characteristics of the Races of Men, in Indigenous Races of the Earth, Philada., 1857, pp. 273–4.

†Observations on the Human Crania contained in the Museum of the Army Medical Department, Fort Pitt, Chatham. By George Williamson, M. D. Dublin, 1857, p. 80.

‡Figured in Crania Ægyptiaca, Plate 11, fig. 2 This drawing very accurately represents the skull in question. The reduced wood-cut in the *Catalogue of Human Crania in the Collection of the Academy*, (p. 34) is an inexact copy of this drawing The outline of the posterior part of the head is drawn inaccurately.

§Plate 5, fig. 4; pl. 12. figs. 1, 2; pl. 6, fig. 2; pl. 6, fig. 8.

‖Pl. 2, fig. 8.

¶Pl 8, fig. 2.

** Nat. Hist. of the Varieties of Man, London, 1850, p. 511.

†† Ibid, p. 514.

very prominent; nasal bones arched with a depression at their root.* Hamilton Smith on the other hand speaks of the "beautiful spherical cranium of the Jews, as fine as the Arabian or Circassian;"† and in a recent work on the *Condition of Women and Children among the Celtic, Gothic and other nations*, it is asserted that the "Jews have, generally speaking, crania like the Saxons and Goths—short and broad," p. (69). This statement is certainly erroneous. The Jewish crania in the Academy's collection are, as we have just seen, long and ovoidal, with a comparatively receding forehead, and as Morton long ago observed, a strong and often harsh development of the whole facial structure. In his interesting work, entitled *Discoveries in the Ruins of Nineveh and Babylon*, Layard figures a bas-relief disinterred from Sennacherib's palace at Kouyunjik, and representing certain Jewish captives from Lachish. "These captives," he says, "were undoubtedly Jews, their physiognomy was strikingly indicated in the sculptures." A glance at these figures is sufficient to show that they belong, not to the short, but the long-headed races of men. The Jews are justly classed, therefore, by Retzius among the Asiatic Dolichokephalæ.‡

The Arab skulls in the collection, with the exception of No. 780, are entirely different from the fragment under consideration. No. 1296 is an oval, dolicho-kephalic head. No. 781 is an oblong head with the occipital region flattened superiorly, as in the Norwegian and Swedish§ skulls, and the occipital protuberance quite prominent. No. 784 is a long head approximating the oval form. Behind the mastoid processes it is quite broad, and the occipital region is full and rounded. No. 780 is a shorter head than the other. The crown exhibits the triangular form of that of the fragment from Jerusalem, but the triangle is longer. The occiput though flattened is not so decidedly flat as in the fragment.

This fragment differs also entirely from the Fellah skulls in the collection, not only in length but also in the configuration of the crown and the occiput.

Upon comparing it with the series of Egyptian skulls, I find that we cannot ascribe to it an Egyptian origin. It is a curious fact, however, and one worthy of mention in this connection, that among the figures in Crania Ægyptica, selected from Rosellini's great work by Dr. Morton to illustrate the Egyptian type of head, there are several which I am strongly inclined to think are not at all Egyptian. Two of these (Fig. 4, p. 34, and Fig. 3, p. 35) are evidently brachykephalic heads. In both, the hind head is vertically flattened. The former resembles the square or round-headed German, the latter calls to mind the Peruvian form. The first outline is that of the Harper in Bruce's tomb at Thebes; the second is a cook, who in the tomb of Rameses the Fourth, at Thebes, is represented with many others in the active duties of his vocation.

Before proceeding further in the attempt to determine the race to which the Jerusalem skull belongs, it will be useful to enumerate the very different races of men that have at different times occupied Jerusalem and its vicinity.

From the Acts of the Apostles we learn that during the first century of the Christian era, there were assembled at Jerusalem, besides the Jews, Parthians, Medes, Elamites, Mesopotamians, Judeans, Cappadocians, natives of Pontus, Asia, Phrygia, Pamphylia, Egypt, Libya about Cyrene, Rome, Crete and Arabia. Long after this we know that crowds of pilgrims were attracted to Jerusalem "from the shores of the Atlantic Ocean, and the most distant countries of the East." Among these pilgrims, Jerome, cited by Gibbon,‖ mentions the Britons and the Indians. Three centuries later, (A. D. 614,) the Holy

* Op. Cit. p. 80.

† Nat. Hist. of the Human Species. Amer. Edit. p. 377.

‡ Opusc. cit. sup. p. 9.

§ See Catalogue of Human Crania, pp. 19, 20. Also Cranial Characteristics of the Races of Men in Indigenous Races, pp. 290, 291.

‖ Decline and Fall of the Roman Empire Chap. 23.

City fell into the hands of the Persian King Chosroes II. In 637 it was conquered by the Saracens, and again became a resort for pilgrims from various parts of the old world. Then it was under the sway of the house of Seljuk; the Turcomans under Ortok having hereditary command of the city and neighboring territory. At length Ortok was driven out by the Egyptians, who in their turn yielded the possession of the holy city to the Crusaders under Godfrey of Bouillon. From the time of Godfrey down to the fall of Acre and the cessation of the Crusades in 1291, a period of some 200 years, the City of the Great King and all Palestine became the sanguinary arena in which the natives of Great Britain, Frenchmen, Flemings, Belgians, Normans, Scandinavian cruisers from the Baltic, Bavarians, Bohemians, Carinthians, Piedmontese, Styrians, Genoese, South Italians, &c., on the one hand, contended with Mussulmen, Mamelukes and the Kharizmian horde from Mongolia on the other, for the possession of the Holy Sepulchre.

Two interesting questions here present themselves. Does this skull belong to any of the races of men, which in successive waves have swept over and occupied, for varying periods of time, the Holy City and surrounding country? Is it possible to indicate the race of which the peculiar form of skull before us is the cranial type? Following the method of exclusion, the only philosophical method available in researches of this kind, where the positive criteria or data for determining a diagnosis are wanting, I have already shown that we can safely affirm that the skull in question is neither Jewish, Arabian, Egyptian ancient or modern, nor Turkish. With equal safety we may say that it is not Roman in its origin or affiliation. For Blumenbach figures the skull of a Roman prætorian soldier (Tab. 32) given to him by the Cardinal Borgia. The configuration of this skull differs from that of the Jerusalem fragment. "Protuberantia occipitalis externa latissima et ingenter eminens" are the words employed by Blumenbach in describing the hind-head of the former. Both Sandifort* and Martin† speak of the broad forehead of the Roman skull, and Retzius,‡ in describing such a skull found in an ancient cemetry at York, also alludes to the "broad and well arched forehead, and the broad, rounded occiput and prominent occipital protuberance," features not found in the Jerusalem fragment. Finally Dr. Thurnam,§ in his description of the skull of Theodorianus, found in a Roman sarcophagus at York, (the ancient Eburacum,) tells us that "the forehead, though low, is remarkable for breadth; that the coronal surface presents an oval outline, and is notable for its great transverse diameter; and that the occipital bone is full and prominent, especially in its upper half." None of these characters are exhibited by the fragment before us.

Is this fragment a Persian head? In the Persian skull figured in Tab. 35 of Blumenbach's *Decades* the occiput is truncated or perpendicularly flattened. In this respect it resembles the Jerusalem fragment. But when we turn to the Persian heads in the Academy's collection we find that they present a rounded occiput. Here then a difficulty occurs at once, as to the normal occipital form of the Persian head. Is there one form which is constant and typical or not? From a general survey of the configuration of the occiput in the various races of men, I am constrained to answer this question in the negative. Only by means of a very large number of native Persian crania can we determine this point. The flatness of the occiput in Blumenbach's Persian skull may or may not be an accidental and unusual feature. Whether it is or not there are differences between the two skulls now under consideration sufficient to assign them to different races. In the Jerusalem skull the whole hind-head is so flattened that it extends but a short distance behind the

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* Tab. Cran. diversar. Nationum, p. 1.

† Man and Monkeys, p 223.

‡ Kraniologisches in Müller's Archiv für Anat., Phys., &c. Jahr, 1849, p. 576.

§ Crania Britannica. Decade I, p 3.

meatus. In the cranium figured by Blumenbach only the extreme portion of the occipital region is flattened, and there is much more of the head projecting back of the bony meatus. We may conclude, therefore, that the fragment does not belong to the Persic type.

Of the cranial characteristics of some of the races mentioned in the 2d chapter of the Acts of the Apostles, I have not been able to find any record whatever. The materials, therefore, for determining positively, by the method of exclusion, the race to which our Jerusalem fragment belongs do not exist. The various races of men occupying from the earliest times the ancient Ionia or Asia Minor and the table lands of Persia and Armenia, constituted a very heterogeneous population, in which Cushite, Shemitic, Arian and Turanian ethnic elements appear to be inextricably blended. Much uncertainty prevails among ethnographers as to the distinctive physical characters of these different races. The national types of the Medes and Parthians are not certainly known. These people are generally ranked among the Turanians, Scythians, or Turk-Tartars; while the Persians, by nearly all chronologists and philologists are looked upon as true Japetidæ. Mesopotamia appears to have been occupied from the remotest epoch by both Shemitic and Arian races. Renan, guided by philological data, considers the bulk of the population to be Shemitic.*. To the Elamites Polybius and Strabo ascribe a northern origin. Josephus considers them to be the "ancestors of the Persians." Certainly in the first Maccabees, Persia and Persepolis are both called Elam. Lenormant, Quatremere, Movers and others consider the Elamites to be a people cognate if not identical with the Persians. On the other hand Löwenstern† thinks that the primitive Elamites were of Shemitic origin, and that in more recent times their ethnic characters were altered by intermixture with Scythic conquerors. It matters not which of these two theories we adopt. For as the Barclay skull differs from both Persian and Shemitic crania, it follows that in all probability it differs equally from the Elamitic skull.

The natives of Pontus were the Tibareni and affiliated tribes on the south-east of the Black Sea in the neighborhood of Colchis. The Tibarenians of Herodotus, according to Dubois,‡ are the Georgians of the present day. If so, the Jerusalem skull never belonged to a "native of Pontus."

If the Guanche skull in the collection represents truly the form of the Libyan or Berber head, the Jerusalem cranium cannot be considered as a specimen of that race;—for the skull of the Guanche is a long oval, terminated posteriorly by a protuberant occiput. In the Museum of the "Carolinischen Institut" at Stockholm, there are four Guanche skulls, which Prof. Retzius speaks of as "grosse, geräumige, ovale Schädel, sehr denen der Araber gleichend." In the anatomical Museum "de l École de Médecine de Paris" there is a skull of a Kabyle woman. From the reference made to it by Dr. Gosse it appears to be a long, narrow skull.§ According to Furnari, however, the Berber cranium is "globuleux et conique en arriere."‖

According to Klaproth the Parthians were cognate with the Getæ, Massagetæ, and other tribes generally included by the ancient writers under the vague and comprehensive term Scythian.¶ Strabo calls them Carduchi, i. e. inhabitants of Curdistan. Pulszky says, "The Parthians were probably not Persians proper, but an unartistical Turanian tribe, held in subjection by the earlier Persians under their Achæmenian kings, which, in its turn, revolting

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* Histoire Générale et Système Comparé des Langues Sémitiques. 1ère Partie. Paris, 1855, Liv. I. Chap. II. § II.

† Revue Archeologique, 1850, pp. 677–723.

‡ Voyage autour du Caucase, Paris, 1840, IV. 321, 328.

§ Essai sur les Deformations Artificielles du Crane. Paris, 1855, p. 59.

‖ Voyage médical dans l' Amérique Septentrionale. Paris, 1815, t. 1, p. 23

¶ Tab. Hist. de l' Asie. p. 40.

from the yoke, ruled the Persians above four centuries."* Judging from the portraits of the 1st, 5th, 12th and 19th Arsaces, on their silver coins in the British Museum, the form of the Parthian skull must have been round or globular.†

Herodotus and Eudoxus, among the ancients, and Renan,‡ Gosche,§ Knobel‖ and others, among the moderns, consider the Phrygians to be closely affiliated to the Armenians. This opinion is based upon purely linguistic considerations. There are reasons, however, for thinking that these two people were not craniographically alike. Both Potocki and Dubois regarded the Phrygians as of Germanic origin. Hamilton Smith also speaks of them as a Getic clan. Among the five characteristic types of man exhibited in the bas-reliefs on the tomb of King Darius Hystaspes, excavated in the mountain Rachmend near Persepolis, there is a Lydian wearing a Phrygian cap, and "representing the mixed population of Asia Minor—a modification of the Arian type by the infusion of foreign blood —Iranian, Scythian and Shemitish interminglings.¶" The head is short and rounded. This is true also of a head of a Lycaonian warrior from a monument of Iconium, in the south-western part of ancient Phrygia. Renan, Movers and Knobel seem inclined to think that the ancient inhabitants of Pamphylia were of Phœnician origin. But the Phœnician, like the Shemitic skull, is dolicho-kephalic. Hence if the opinion of these gentlemen be well grounded, the short-headed Jerusalem fragment is not Pamphylian.

From these statements it will be seen that the Parthians, Phrygians, and perhaps also the Cappadocians and Cretans belong, in common with the Sclavonians, Finns, Turks, Kalmucks, &c., to the same short-headed group of crania to which must be assigned our Jerusalem skull. Of the exact form of their heads, however, I can obtain no satisfactory information. The affiliations of the Jerusalem skull must be sought in this direction. But the attempt to determiue its exact place in the ethnographic scale is still further complicated by the question of deformation. Is it a deformed skull? It is not easy to answer this question positively. Deformed or distorted skulls are referrible, as regards the cause of distortion, to three classes, viz: 1st. Skulls artificially deformed by bandages, &c.; 2d. Skulls posthumously distorted in consequence of interstitial changes produced by the combined influence of pressure and moisture; and 3d. Skulls naturally or congenitally deformed in cousequence of obliteration by synostosis of some one of the sutures, this obliteration taking place during intra-uterine or early extra-uterine life and by presenting a point of resistance, causing the brain and with it the calvarial bones to be unduly developed in certain directious, as has been very clearly shown by Dr. Humphry Minchin, of Dublin.** Now a careful inspection of the Jerusalem skull shows that no synostosis either of the lambdoidal or the posterior part of the sagittal suture can be pointed out. The occipital and parietal bones have been developed in the usual manner and from ossific points of ordinary number and location. The sutures mentioned though nearly consolidated have not been obliterated. The deformation is, therefore, not congenital. It is not posthumous, for if it were, the sutures would in all probability gap, and not admit of coaptation, and the head would be asymmetrical. We may conclude then that the head has been artificially deformed, by pressure strongly, evenly

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* Indigenous Races of the Earth, "Iconographic Researches on Human Races and their Art," p. 151.

† Ibid, pp. 170–171.

‡ Op. Cit., p. 44.

§ De Ariana linguæ gentisque armeniacæ indole. Berlin, 1847.

‖ Die Vœlkertafel der Genesis, p. 98.

¶ Iconographic Researches, p. 151.

** Contributions to Craniology. Dublin, 1856.

and continuously applied to the occipital region during growth. Formerly the custom of distorting the head was supposed to be confined to the American aborigines. It is now known to have prevailed in various parts of the old world as well as in the new. The Jerusalem skull is a strongly marked, perhaps I may say, an exaggerated example of the *Tête deprimée par dérrière*, of Dr. Gosse, of Geneva. This excellent craniographer divides all artificially deformed skulls into sixteen classes. In the fifteenth he places occipitally flattened crania. Besides the Peruvian and other aboriginal Americans, the Tahitians, according to Ellis,* and the natives of the Nicobar Isles, according to Nicolas Fontana,† were in the habit of flattening the heads of their children in this manner. Insfeld, cited by Sœmmering,‡ says of the Kalmucks, "quadratum formam appetunt." We learn from Vesalius that occipital deformation was practiced in his time by certain German tribes. "Germani," he writes, "vero compresso plerumque occipite et lato capite spectantur, quod pueri in cunis dorso semper incumbant, ac manibus fere citra fasciarum usum, cunarum lateribus utrinque alliguntur." Hence, the term *tête carrée* applied to the Germans. Vesalius also writes of the Turks: "Turcarum capite globi fere imaginem exprimunt, ad hanc quoque obstetricibus nonnunquam magna matrum sollicitudine opem ferentibus." The Tahitian and Nicobarian crania being dolichokephalic, we may, on this account, as well as for obvious geographical reasons, set them aside, as we have already the Turks, in our attempts to determine the nationality of the Jerusalem skull. We thus limit ourselves to a choice between the Mongols, Germans, Peruvians, and, for reasons presently to be stated, the Sclavonians, and a certain brachykephalic race, cranial specimens of which have been found in the Catacombs of Paris, by the late Dr. Harlan, and placed in the Academy's collection by his son. One of the latter, No. 664, bears much resemblance to the Barclay skull. The two, however, are by no means, identical in form. For the forehead in No. 664 is broader in proportion to the hind-head than in the Jerusalem skull; the crown in the former is consequently less triangular, and the occiput, though flattened in the same way, is not so decidedly and broadly flattened. The crown of our Jerusalem fragment more closely resembles that of a Sclavonian head from Olmutz, No. 1251 of the collection. The calvaria in both is triangular in shape, but more elevated at the junction of the sagittal and coronal sutures in the Sclavonian than in the skull from Palestine. The occipital region in the latter is globular, and has not been subjected to the flattening process. Nevertheless, if it had been vertically flattened by art, we can well imagine that it would have strikingly resembled the Jerusalem skull. The Sclavic skull from Morlack, in Dalmatia, exhibits an oblong coronal region. The shape of the crown in the short-headed German type (such as seen in Nos. 37 and 1063) is a rounded square. In the German head, No. 706, the crown is triangular, but that part at the junction of the sagittal and coronal sutures, is very much arched, and in this respect is unlike the Jerusalem fragment. In the long-headed Germans the crown forms a broad oval. The Jerusalem skull very closely resembles the cast of a Burat Mongol head, No. 1355 of the collection. It also resembles the Kalmuck skull, No. 1553, though less decidedly. In the brachykephalic Burat head there is the same triangular crown, narrow at the forehead and broad between the parietal bosses; the same moderate fulness of the centre of the dome, and the same symmetry. Had the occiput been flattened the forms of the two crania would have been identical. As it is, the occipital region projects but a short distance behind the foramen magnum, so that very little compression would be necessary to

* Polynesian Researches, London, 1831, vol. 1, p. 80.
† Asiatic Researches, London, 1799, vol. 3, p. 151.
‡ De Corp. Human. Fab. Traject ad Mœnum, 1794, 1, 62.

givo to it tho occipital form of the skull from Jerusalem. The absence of the truncated occiput in the only specimen of the Burat type in the collection need not deter us from referring tho Barclay fragment to this type. I have already noticed the fact that the Kalmucks were in tho habit of giving a square form to the head. This practice was confined to male children. Females were for the most part exempt from it, and consequently retained the form of head given to them by nature. It is curious to observe that the Burat cast has every appearance of being the cast of a female skull—of one, therefore, which has escaped compression. As if to confirm tho reference here made of the Jerusalem skull to the Burat cranial type, I may say, that after the above lines had been written, I received a copy of Dr. Latham's "Descriptive Ethnology," published during the current year. In tho first volume, when describing the Mongolian physiognomy, he alludes to my description of the only Kalmuck skull in the Academy's collection, and quoting Blumenbach's epithets, says that the cranial collection in the Berlin Museum, the largest he has seen, verifies these epithets. He says further, that "the base of some of the Burat crania, and the *truncation of the occiput, are in some cases inordinate.*" (p. 339.) I find additional confirmation of the ideas here advocated in a posteriorly flattened skull brought to the Academy, within a few days past, by Mr. J. H. Slack, who informs me that it belonged to the collection of Prof. Weinland, and was found upon the battle-field of Balaklava. Though labelled Cossack, it is undoubtedly of Mongolian origin. In many respects it is analogous to the Kalmuck skull No. 1553 of the collection, but unlike this latter it has the occiput flattened. The Cossacks, it will be remembered, are a mixed people, made up chiefly of Sclavonians, Turks and Mongols, the latter ethnic element predominating.

The Jerusalem skull resembles Nos. 85, 87, 450, 688, 752, 1232, 1458, 1459, 1464, 1473, 1481, 1493, 1495, 1504, 1509, 230, 497, and others of the Peruvian group. The former is, however, not identical in conformation with the latter. Nearly all these Peruvian skulls are irregularly distorted, and in most of them the sinciput appears to have been compressed as well as the occiput. Although distorted by the same means, and in general outline very much alike, yet they differ to some extent from each other in the shape of the crown, and even in the extent and direction of the occipital flatness. Except in the fact that the Burat and Kalmuck skulls are not artificially flattened as the Barclay cranium has evidently been, these three resemble each other more closely than the latter does the Peruvian. Nevertheless, the short-headed and occipitally flattened Peruvian skulls and our Jerusalem fragment are referrible to the same type, or at least to types so closely related that it requires careful examination to discriminate between them. Are we justified on this account in regarding the cranium from Jerusalem as a Peruvian skull? I think not. To refer a skull to its formal type is not the same as referring it to its appropriate race, nation or tribe. Two skulls of the same type may belong to very different races. This fact is involved in a curious law of homoiokephalic representation, which has been entirely overlooked by craniographers, and the neglect of which has in several instances, led to very curious mistakes. The ancient Avarian skull found at Grafenegg, in Austria, by Count Von Brauner, so closely resembled some of the elongated and cylindrically compressed Peruvian skulls, that Von Tschudi declared it to be of Peruvian origin, and supposed that it had been brought over from Peru to Austria with other collections. Prof. Retzius, with greater diagnostic skill, pointed out certain differential characters which were overlooked or regarded as of no importance by Von Tschudi, and pronounced the skull to be indigenous to Europe and to have belonged to the Avarians. This opinion, which at first gained no support, was afterwards proven to be correct by the discovery of similar skulls at Atzgersdorf, near Vienna, in Austria, at the village of St. Romain in Savoy, and in the valley of the Doubs, not far from Mandeuse. Fitzinger, Troyon,

Gosse and Duvernoy examined these crania and confirmed the opinion of Retzius. The first mentioned observer has shown that they resemble in every particular certain crania found in the Crimea and described by Rathke and Meyer.* To refer the Barclay fragment to the Peruvian race would be to repeat the mistake of Von Tschudi.

Thus, then, from the foregoing details we may conclude quite positively that the skull found by Mr. Barclay is neither that of a Jew, Arab, Egyptian, Fellah, Turk, Roman, Persian, Elamite, Tibarenian nor Libyan. Reasons have also been adduced opposing the ascription to it of a Peruvian origin.

It may have belonged to the Parthians, Phrygians, Mesopotamians, Cappadocians or Cretans, in so far as these are representatives of the so-called Turanian type. The craniographic data necessary to determine this point satisfactorily are almost entirely wanting.

It is, in all probability, either a Mongolian or a Sclavonian skull. In some respects it resembles both, in some respects it differs from both. Hence the difficulty of determining between the two,—a difficulty increased by the fact that these two cranial forms or types are themselves closely related, and possess features in common, and that the differential characters by which they are distinguished reside chiefly in the facial and basal bones, parts which are wanting in the Jerusalem fragment. The latter, however, as we have seen, resembles more closely the Burat cranial form than that of the Moravian variety of the Sclavic. It resembles the former more strikingly perhaps than any other head in the collection that has not been deformed. Still it may approximate just as closely the head of a Tschek, Wend, Slovack, Croat, Serbian, Pole or any other representative of the great Sarmatian stock. I cannot make the necessary comparisons to determine this point, for the Academy's collection contains no specimens of these transitionary races. I say transitionary, for through these Sclavonian tribes the brachykephalæ of Europe graduate into the brachykephalæ of Asia. To be more precise, I may say, indeed, that an attentive consideration of the Burat skull-type leads me to the belief that the short-headed races of Eastern Europe graduate into the Kalmucks and Mongols proper of Asia through the Sclaves and Burats of Lake Baikal. The latter people, judging from the cast in the Academy's collection, belong to a type somewhat higher in the human cranial scale than the Mongolian. According to Tchihatcheff, they manifest more aptitude for civilization than the pure Mongolian tribes.

The type of the Burat head being displayed in the fragment from Jerusalem, I refer the latter provisionally to the people and the region about Lake Baikal.

This opinion is announced not as a positive and indisputable conclusion, but as an approximation to the truth,—an approximation, moreover, whose scientific value is necessarily as incomplete as the facts upon which it is based are limited.

From the foregoing remarks it will be seen that neither occipital nor calvarial characters *per se*, are as valuable as is generally thought by craniographers in determining the race to which any particular skull belongs. In like manner basal, facial or lateral characters, taken singly, will not be sufficient to determine the type of a skull. This type is found neither in the base, nor in the dome, neither in the occiput nor the sinciput alone. To a great extent it resides in the sutures, and is determined partly by the number and location of the ossific centres, and the rapidity with which development proceeds from such foci, and partly by the extent and direction of this development. During

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* See Proc. Acad. Nat. Sci. vii. 405; compare also Fitzinger's Essay "Ueber die Schädel der Avaren" Wien, 1853; and Retzius' "Blick auf den gegenwärtigen Standpunkt der Ethnologie," Berlin, 1857, pp. 42, 43.

the centuries that have elapsed, since man first appeared upon the surface of the earth, the ethnical peculiarities which appear to have originally characterised the laws of cranial development in the different races of men, have become so masked or modified by hybrid interminglings of varied degree and kind, that the great principle of the correlation of forms is scarcely available in inferring from one or more fragments of a skull the typical form of that skull. Cuvier, the discoverer of this important principle of palæontology, regarded every organized being as a whole, whose different parts correspond to each other in such a manner that none can change without the others changing also. Consequently, to him not only each part, but each fragment of a part, appeared to be the index of all the others. He asserted that not only the class, but the order, the genus, and even the species are expressed in the form of each part, in the smallest apophysis, the smallest bony facet. Guided by this teleological principle, the sagacious Cuvier, from the examination of a single tooth, was enabled to announce the character of the entire skeleton of an extinct reptile. The jaw bone and teeth of an extinct species of animal then unknown (Phascolotherium Bucklandii) he correctly ascribed to a marsupial quadruped allied to the opossum. In like manner the fragment of a fossil femur, found in New Zealand, was referred by Prof. Owen to an extinct genus of tridactyle Struthious birds. The correctness of this reference was afterwards attested by the discovery of numerous remains of several species of this genus. So also, Prof. Leidy, following the same great law of the harmonization of forms, was enabled to assign the fragment of a fossil molar tooth, from Missouri Territory, to a species of rhinoceros. Subsequently, he received from the same place fragments of the maxillæ and cranium of this species sufficient to confirm positively his opinion. Still more recently he referred a fragment of the anterior portion of a fossil upper jaw, from the valley of the Niobrara river, to a species of camel, and this reference was confirmed by the discovery of an entire jaw of the animal bearing the peculiar hook-like process, which differentiates it from all other ruminants.

But, though the palæontologist and comparative anatomist can, from minute fragments of bone, reconstruct many of the extraordinary species of animals that flourished in earlier geological epochs, yet the student of human craniography can seldom, with any certainty, indicate from a fragment the type and race of a skull. The palæontologist is assisted to his conclusions by the law of co-existing elements or harmony of forms, and when this fails, as it does at times, and as it occasionally did even in the hands of its illustrious discoverer, he can resort to the comparison of the fossil remains he may be studying with the similar parts of animals now existing. The craniographer cannot avail himself of this law of correlation. The existence of numerous transitionary forms, partly natural, partly hybrid, occupying places between the leading, typical stocks, and causing these latter to graduate into each other, in some instances almost insensibly; the difficulty of distinguishing between natural and hybrid sub-types; the existence of artificially deformed crania among different races in both hemispheres, some of them being purely arbitrary or conventional, and some of them imitations of natural but little known forms, all constitute serious obstacles to the practical application of this law to human crania. A still greater difficulty, moreover, is found in the fact that, in its practical working, this law is seen to be more generic than specific. In other words it differentiates genera better than species; species better than varieties. With the latter, though theoretically true, it is practically valueless. Cuvier himself was unable to point out specific osteological differences between the lion and tiger, the horse and ass, the dog and wolf, the leopard, panther, wild and domestic cats, &c. He was unable, consequently, to satisfy himself of the precise organic form or specific type to which the fossil representatives of these species belonged. Even, in regard to living species, Cuvier acknowledged that "La classe des poissons est de toutes, celle qui offre le plus de difficultés quand

on veut la subdiviser en ordres d'après des caractères fixes et sensibles."* Nevertheless, it is well known that Agassiz, abandoning the Cuvierian method of comparing animals by their organs, and adopting Bichat's scheme of comparing the tissues of organs instead, was enabled to reconstruct the fishes of the fossil world by noting carefully the characteristics of their tegumentary membrane.

If it be true, indeed, for the animal world at large, as maintained by Knox, that specific characters are in the main external; and that the anatomy of the interior leads to higher considerations than the mere determination of species; and if it be true, that, on this account, the law of correlation so often fails in its application to species, still more should it fail when used as a means of diagnosticating human crania from each other. For a serial unity of form is here more manifest than in the animal world proper, and this unity has become still more apparent under the combined influence of civilization and hybridity. In long periods of time civilization appears to be capable of modifying human cranial forms to a slight though appreciable extent. Hybridity, by introducing intermediate or transitionary forms, gives to osteological characters, originally differential, an uncertain or fluctuating value. Naturalists are not agreed whether the carnivora of the fossil world were identical with the lions, tigers, panthers, leopards, &c., of the present time, or were specifically distinct from these. They are not yet decided whether all the species of the present fauna of this continent are distinct from those found fossil in the post-pliocene deposits of South Carolina or not. They find that the teeth and bones of the living rabbit, raccoon, opossum, deer, elk, hog, dog, sheep, ox and horse, cannot be distinguished anatomically from similar remains found in these deposits, and they are consequently at a loss whether to regard the former as the direct descendants of the latter, or entirely distinct from them; and this, too, notwithstanding that the fossil specimens are found associated with the remains of animals positively known to be extinct,—such as mastodon, megatherium, hipparion, &c † They are not agreed whether the fossil horse resembled the quagga, the zebra, the dziggnetai, the domestic horse, or an animal wholly and specifically distinct from all these. Agassiz "entertains doubts respecting the unity of origin of the domesticated horse."‡ According to Knox, the fossil horse belongs to no species of this animal now living.§ Prof. Owen finding that one of the teeth of a certain fossil horse is somewhat more curved than the corresponding tooth of the recent horse, declares the former to be a distinct species, and names it Equus curvidens. Prof. Leidy is persuaded that many remains of an extinct species of horse, from the post-pliocene of this country, are undistinguishable from the recent one. The specimens of teeth of this animal, which he has had the opportunity of exhibiting, present so much difference in condition of preservation or change in structure; so much variation in size, from that of the more ordinary horse to the largest English dray horse; and so much variableness in constitution, from that of the recent horse to the most complex condition belonging to any extinct species described, that it would be about as easy, he thinks, to indicate a half dozen species as it would two.‖ So it is with the varied cranial forms displayed in the great natural family—man. Of human crania, it is just as easy, indeed, I think it is easier—to make twenty-seven races, types, permanent varieties, or species—call them what you will—as it is to make any less number—so very mobile, so very elastic is the fundamental plan or structural type of the human skull. The uncertainty which surrounds the definition of the species of the genus Equus, exists also in connection with the

*Règne Animale, t, ii p. 28.

†See Proceedings Acad Nat. Sci., July 1859, p. 184.

‡See his letter addressed to Prof. Holmes, in Proc. Acad. Nat. Sci., July 1859, p. 186.

§Introduction to Inquiries into the Philosophy of Zoology, in London Lancet, for October, 1855, p. 275.

‖Proc. Acad. Nat. Sci., July, 1859, p. 182.

genera bos, ovis, capra, ursus, canis, felis, sus, and other extant natural families, representative remains of which have been found in strata appertaining to geological epochs anterior to our own. Difference of species for Ursus maritimus and Ursus Americanus could not be predicated upon the skulls only of these animals. The crania of Felis canadensis, F. concolor, F. chalybeata, &c., in the Museum of the Academy, are identical in form and dentition with the skull of F. tigris. So, also, the skulls of Canis lupus, and C. familiaris are identical with each other. I doubt if there is the anatomist living who from the study of one or several bones of the head of one of the above mentioned species, could unerringly refer them to their proper species. Still less, if the animal were extinct, could they restore the species. To their appropriate genus these bones might be restored, and this genus might be reconstructed, but nothing more. So, also, supposing the Jew, the Gipsey, and the Eskimo, all long-headed people, were extinct, I feel very certain that no ethnologist could, from their crania alone, restore the distinctive, ethnic features of these people,—the prominent, unmistakable nose and mouth of the first the long, dark and squinting eyes, and narrow radix nasi of the second, the stunted form and flat, lozenge-face of the last. On the other hand suppose the Finn, the Lapp, the Turk and the Sclav, all long-headed people, were among the past and gone. Then the problem would be, if anything, still more difficult. For these crania resemble each other much more closely than do those of the Eskimo, Gipsey and Jew. If we were to contrast the skull of an Eskimo with that of a Sclav or a Turk, or the skull of a Gipsey or Jew with that of a Finn or Lapp we should soon discover that there were greater differences between the crania thus compared, than between the different species of Ursus, or of Canis, or of Felis. The most striking difference is to be found in the length or antero-posterior dimensions of the two classes of skulls. Upon this feature, indeed, Retzius has founded his two groups of human crania—the dolichokephalic and brachykephalic. But this difference in length is accompanied by other characters, some of which though less striking to the ordinary observer, are not the less valuable and distinctive, in an ethnical point of view. If all skulls were either long or short the craniographer might readily refer any particular skull submitted to his inspection to one or other of these two classes. But there are many crania which are shorter than the so-called "long skulls," and yet longer than the so-called "short skulls." These constitute a class intermediate between the dolichokephalæ and brachykephalæ, into which they graduate on either hand so insensibly that they are separable from them by no trenchant lines. A skull having been placed among the dolichokephalæ, or it may be among the brachykephalæ, it is still as far from being minutely classified as the head of a dog which has been located in a group called simply "Canis." It may be orthognathic or prognathic, it may be square-, oblong-, oval-, or lozenge-faced; it may have an oval, triangular or square crown. In many skulls these features may be, and, indeed, are, variously combined. Individual crania of the same group not unfrequently exhibit these features differently combined. On the other hand two skulls closely resembling each other may belong to distinct races differing in general appearance, in language, in habits, in intellectual and instinctive traits. Contrast, for example, the skull of a Græco-Egyptian, No. 837 of the collection, with that of an ancient Swede, No. 1249. These heads differ no more from each other, than they respectively do from the other specimens of the groups to which they severally belong. Upon our side of the Atlantic the Swedish crania find their representatives in the Arickaree Indian skulls.

The Academy's collection furnishes other examples of this seeming paradox; some of them exhibited by races which occupy widely separated localities, and of the assumed community of origin of which there is not only no scientific proof of a positive character, but even no presumptive testimony that is reliable. The recognition of such facts led me, more than two years ago, to

express my conviction that strong resemblances between human, cranial types do not infallibly indicate a common parentage,—such resemblances merely manifesting similarity of position in the human series.* Human osteology, however, is not peculiar in this respect. Prof. Agassiz thinks that the circumstances under which were found the fossil remains obtained by Prof. Holmes from the post-pliocene or post-tertiary beds of South Carolina, "show beyond the possibility of a controversy,"—I am using his own strong language,—"that animals which cannot be distinguished from one another, may originate independently in different fauna."† It will thus be seen that in many instances to refer a skull to its appropriate formal type is one thing; to refer it to its proper race, quite another. An obscure system of homoiokephalic representation seems to prevail among the races of men, in virtue of which the cranial type of one race repeats itself among another people, very distant from, and unknown to the first. Hence the law of cranial correlations is, to a certain extent, obscured, and its utility in identifying and classifying human skulls very much impaired. But the great difficulty after all with the craniographer is to fix upon characters which are at once definitive, differential and constant, and therefore typical beyond all doubt or cavil. The skulls of the orthognathic Greek, and the prognathic Saharan Negro differ more from each other than do those of the nandu and ostrich, those of the llama and camel, or those of the genera Tarandus, Alces, Cervus, Panolia, Axis, Cariacus, Blastocerus, Capreolus and Cervulus into which naturalists divide the Cervidæ. But the negro differs cranially as much from the Eskimo, the Phœnician and the Malay as from the Greek. Yet the Eskimo, the Phœnician and the Malay, like the woolly-haired typical African, are all prognathic. The prognathism of the one, however, differs in kind from that of each of the others. Here, then, are differences which, though minute, serve to alter the entire physiognomical expression of a skull, and so affect not only its classification but its identity also. When we compare together extreme crania, without reference to intervening forms, these differences are seen to be differences of kind. But as soon as we take into comparison the transitionary cranial forms or types, which fill up the space or gap between these extremes, then these differences become differences of degree rather than of kind.

The same uncertainty characterises the species of many genera of birds, reptiles, shells, plants, &c. Dr. Adam Smith placed in a row all the known species of the natural family of the Alcaudæ, and in presence of such an ordeal, all the pretended specific external characters of naturalists completely broke down. Dr. Knox dissected the serpents of South Africa, and divided them, according to the dentition, into those with poison fangs, and those without. This he regarded as a scientific distinction. But when he began to dissect the serpents of the globe and not those of any particular region he quickly found that the distinction was invalid. That certain species of insects carry poisonous fangs only on the upper maxillary bones is true; but as there are many which carry also harmless teeth on the same bones, the fact becomes of little or no value scientifically or practically.‡ It is needless to multiply proof in this direction. Indeed it seems to be a general fact that just in proportion as the species of a genus become more and more numerous, their differential characters become more and more confused and uncertain, and the species when ranged side by side are seen to blend with or pass into each other in obedience to a great, fundamental law of graduation through which their true structural unity finds its only expression. Viewing the facts of specific differences in this comprehensive way, and bearing in mind that the question of

* Cranial Characteristics of the Races of Men, in Indigenous Races of the Earth, p. 349.

† See his letter to Prof. Holmes in Proc. Acad. Nat. Sci. loc. citat., p. 186.

‡ Contributions to the Philosophy of Zoology, with special references to the Natural History of Man. London Lancet, November, 1855, p. 386.

origin or parentage is not *necessarily* connected with that of cranial forms, it is evident that if we accept for man the recognised principles of zoological classification, we must regard the human family as a genus represented by numerous species, whose differential characters touch, so to speak, or even overlap each other. There is undoubtedly a serial unity of all human crania. There is, in other words, *a* human cranial type—the type of a natural class or family widely separated from the most anthropomorphous apes—a type susceptible of very numerous, but individually limited, modifications, the result of climatic conditions, and persisting as long as the conditions which bring them into existence continue; a type susceptible, also, of hybrid modifications, which though ephemeral and not self-sustaining as are the great stocks, are transitionary and therefore valuable as showing all the possible variations of the primal or central form. All these variations tend constantly to assume the normal type, to assume it indirectly or spirally, as it were, so that the extremest departure from the type is bound to the latter through graduated forms, in such a manner that when the extremes of the series are compared together with reference to these forms, it is difficult to point out the constant and unvarying differential characters.